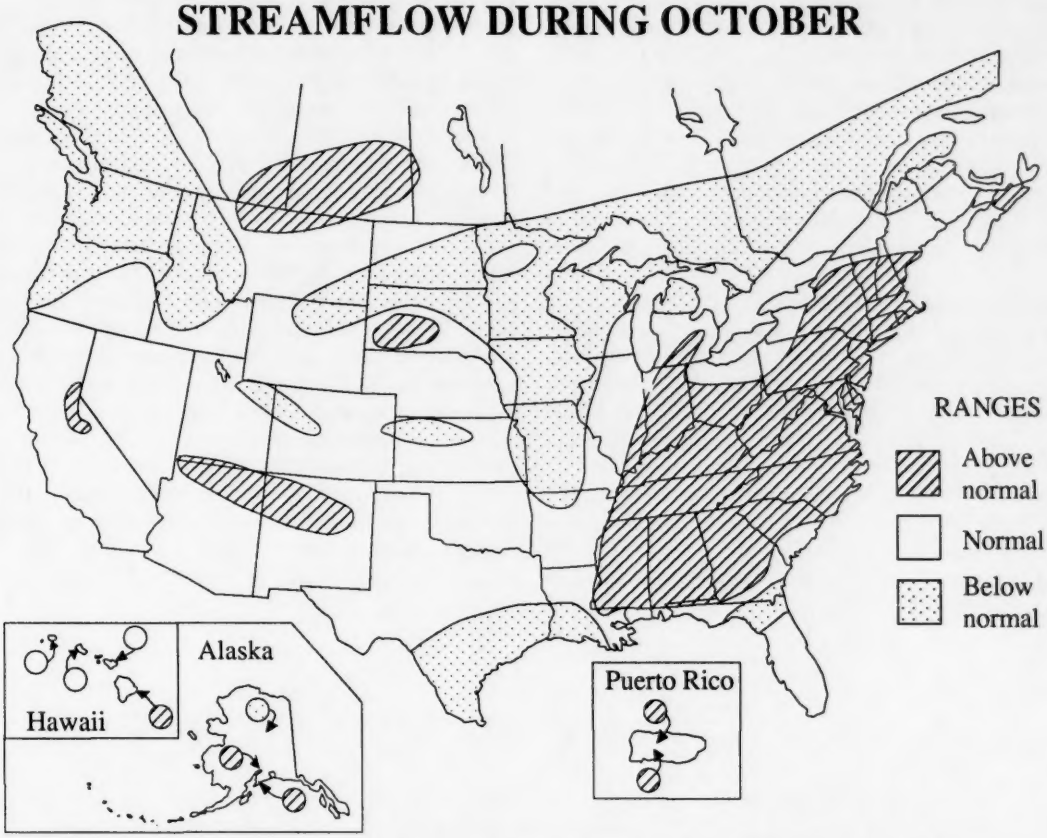
# National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

## OCTOBER 1989

### STREAMFLOW DURING OCTOBER




Flooding occurred in northeastern and north-central Georgia after heavy rains September 30-October 1.

In Florida, urban flooding occurred in Melbourne (Brevard County) on October 9, and in St Augustine (St. Johns County) October 10.

Flooding occurred in eastern Kentucky October 17-18 and damages were estimated at $11.4 million.

Streamflow was in the normal to above-normal range at 73 percent of the index stations in southern Canada, the United States, and Puerto Rico during October. Below-normal range streamflow occurred in 29 percent of the area of southern Canada and the conterminous United States. Total flow was 24 percent above median.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—was in the normal range but 21 percent above median during October.

Monthend index reservoir contents for October 1989 were in the below-average range at 22 of 100 reporting sites. Reservoirs with contents in the below-average range and significantly lower than last year (with normal maximum contents of at least 1,000,000 acre-feet) were: Gouin, Quebec; International Falcon, Texas; Lake McConaughy, Nebraska; Lake Oahe, South Dakota; Fort Peck, Montana; the Pathfinder and associated reservoirs, Wyoming; Bear Lake, Idaho-Utah; and Lake Berryessa, California.

Mean October elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range on all the lakes except Lake Superior, where the mean was in the below-normal range.

Utah's Great Salt Lake declined to 4,204.50 feet above National Geodetic Vertical Datum of 1929 in October.

# STREAMFLOW CONDITIONS DURING OCTOBER 1989

Minor flooding occurred in northeastern and north-central Georgia after heavy rains September 30-October 1. Recurrence intervals were less than 10 years except at three streamflow stations, Broad river near Bell, Kettle Creek near Washington, and Sope Creek near Marietta, where peak discharges had recurrence intervals of 50 years.

On October 9, 6-7 inches of rain fell in 24 hours in the Melbourne area of Brevard County, Florida. Street flooding occurred, but no major damage was reported. On October 10, 16.08 inches of rain fell in 14 hours (2 a.m. to 4 p.m.) at St. Augustine, St. Johns County, Florida. The rains were caused by a cold front that stalled, moved back as a warm front, and stalled again. Strong northeast winds added to the flooding in downtown St. Augustine. On the west side of town, 4 feet of water covered many roads and the streets in the historic district had 1.5-2 feet of water. The previous maximum 24-hour rainfall was 9.52 inches September 18, 1963. No major damage was reported.

Flooding occurred in eastern Kentucky October 17-18 as 6 inches of rain fell in some parts of the area. At least 1,000 persons were evacuated but there were no deaths reported. Damages were estimated at $11.4 million and the Governor of Kentucky declared 10 counties disaster areas. Most of the damages were to bridges (both public and private) but many homes and commercial structures were also damaged.

Streamflow was in the normal to above-normal range at 73 percent of the 192 index stations in southern Canada, the United States, and Puerto Rico during October, compared with 80 percent of stations in those ranges during September, and 65 percent of stations in those ranges during October 1988. Below-normal range streamflow occurred in 29 percent of the area of southern Canada and the conterminous United States during October compared with 14 percent during September. Total October flow of 1,453,700 cubic feet per second for the 182 index stations in the conterminous United States and southern Canada was 24 percent above median after a 3 percent decrease in streamflow from September to October, and 46 percent more than flow during October 1988.

Three new monthly extremes (one low and two highs) occurred at streamflow index stations during October, the same as during September. Hydrographs for those three index stations and four new index stations are shown on page 4.

Streamflow conditions during October 1989 and October 1988 are shown by maps on page 5. The percent of area in each flow range is about the same during both months but the spatial distribution of areas in the three flow ranges is quite different.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 774,300 cfs (21 percent above median and in the normal range) during October, 6 percent less than during September. Flow of the Columbia River was in the below-normal range after 2 months of flow in the normal range. Flow of the St. Lawrence River was in the normal range for the fifth consecutive month. Flow of the Mississippi River was in the above-normal range for the second month. Hydrographs for both the combined and individual flows of the "Big 3" are on page 6. Dissolved solids and water temperatures at five large river stations are also given on page 6. Flow data for the "Big 3" and 42 other large rivers are given in the Flow of Large Rivers table on page 7.

(Continued on page 12)

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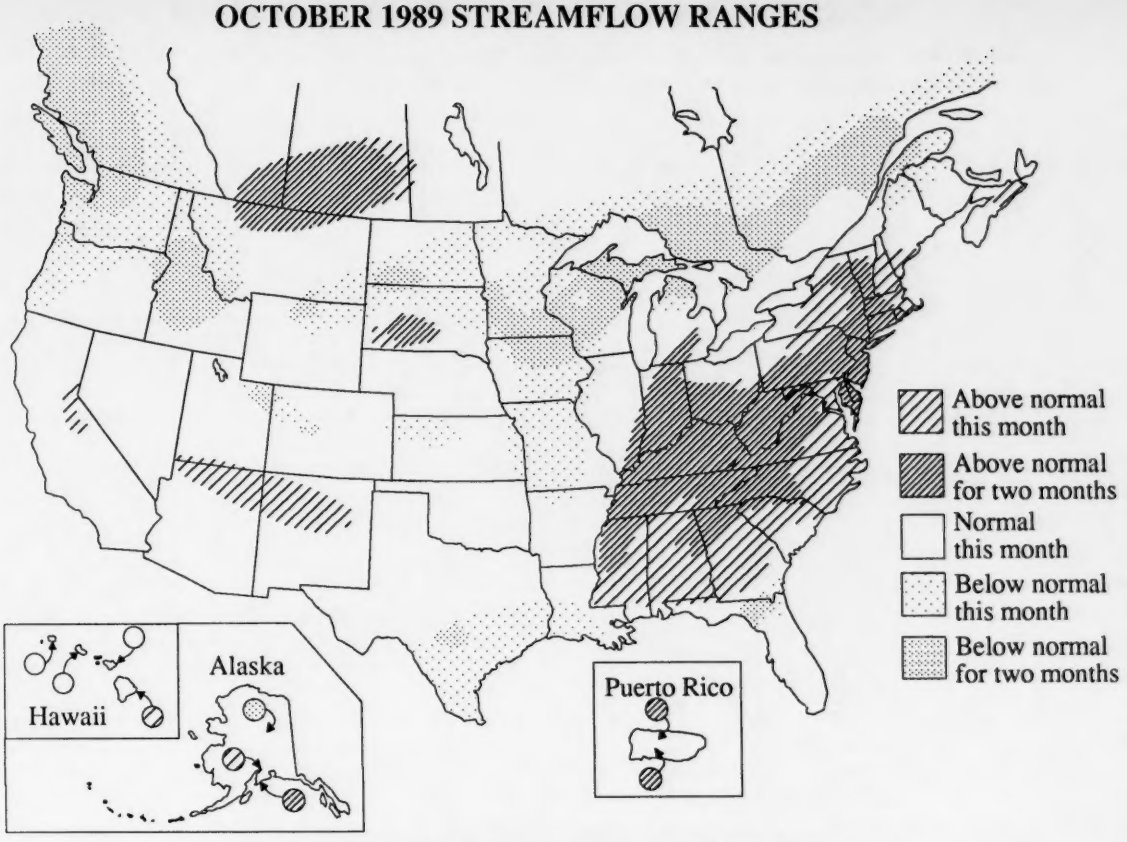
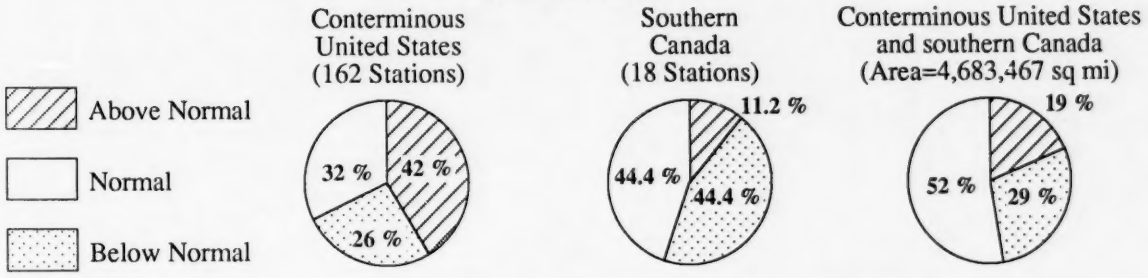
## OCTOBER 1989 STREAMFLOW RANGES

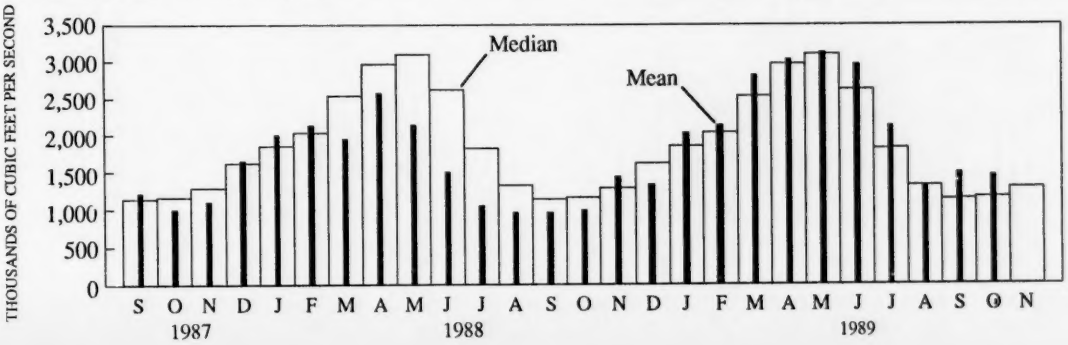



## SUMMARY OF OCTOBER 1989 STREAMFLOW

FLOW RANGES

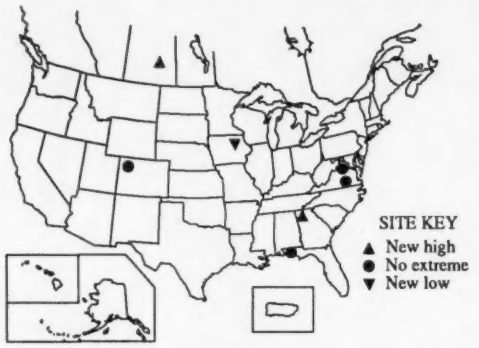


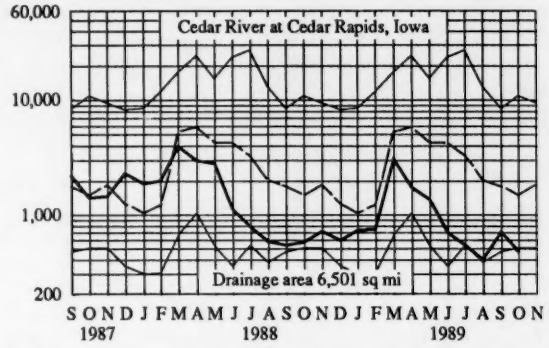

## COMPARISON OF TOTAL MONTHLY MEANS WITH TOTAL MONTHLY MEDIANS



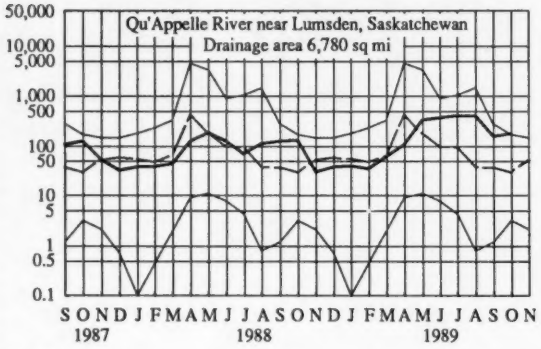
## MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

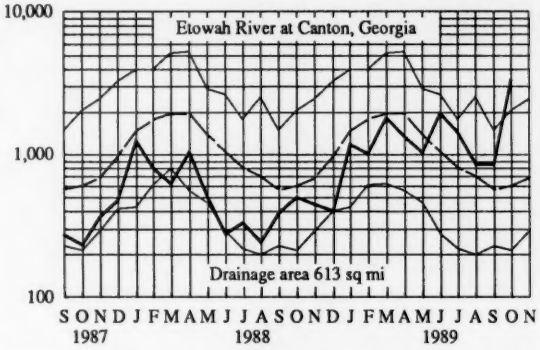
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.

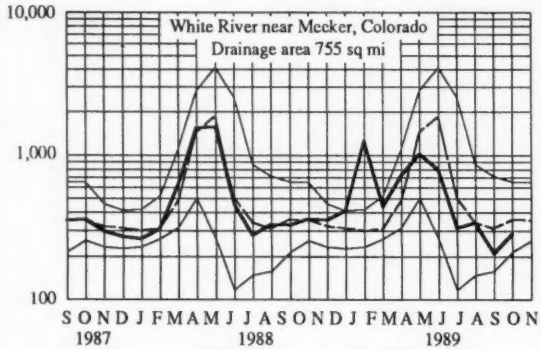


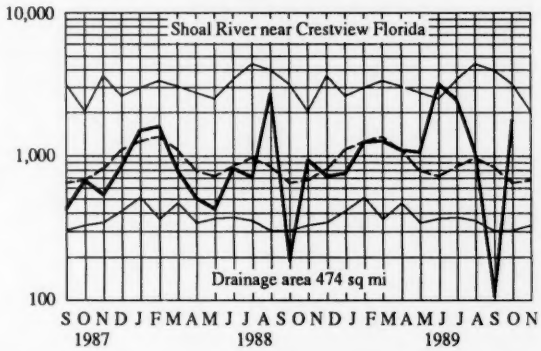


Cedar River at Cedar Rapids, Iowa
Drainage area 6,501 sq mi
60,000
10,000
1,000
200
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1987
1988
1989

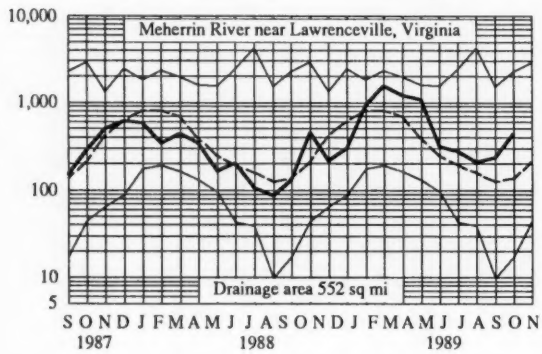
DISCHARGE IN CUBIC FEET PER SECOND

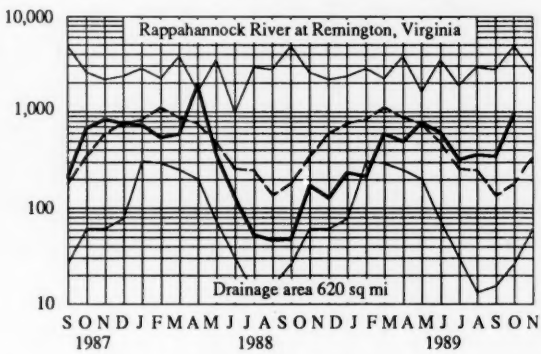


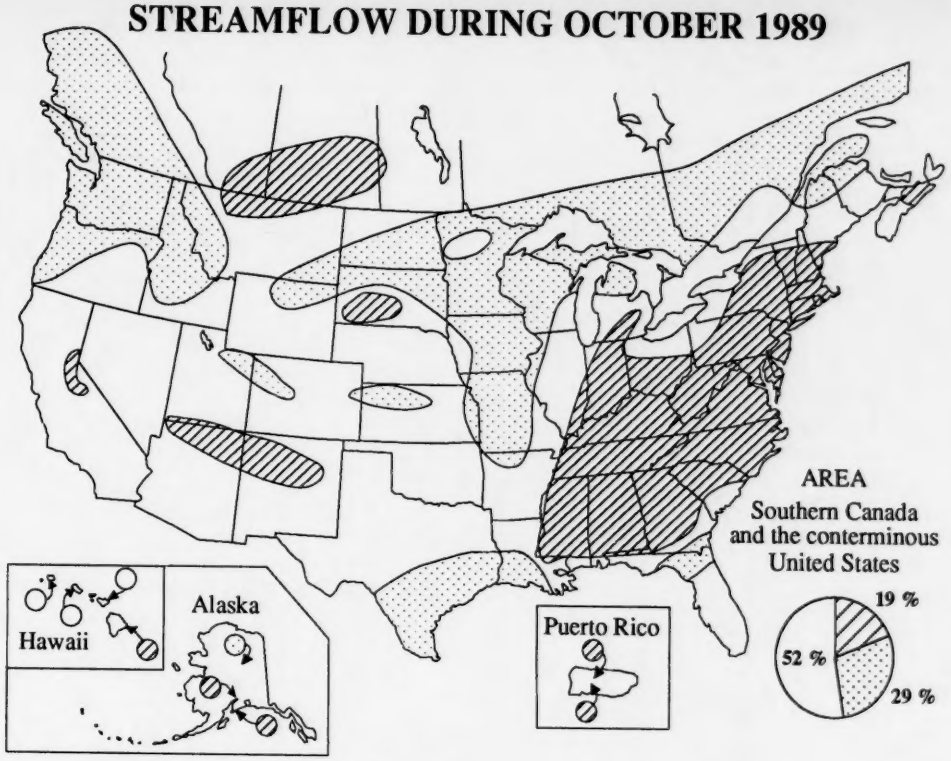





Shoal River near Crestview Florida
Drainage area 474 sq mi
10,000
1,000
100
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1987
1988
1989

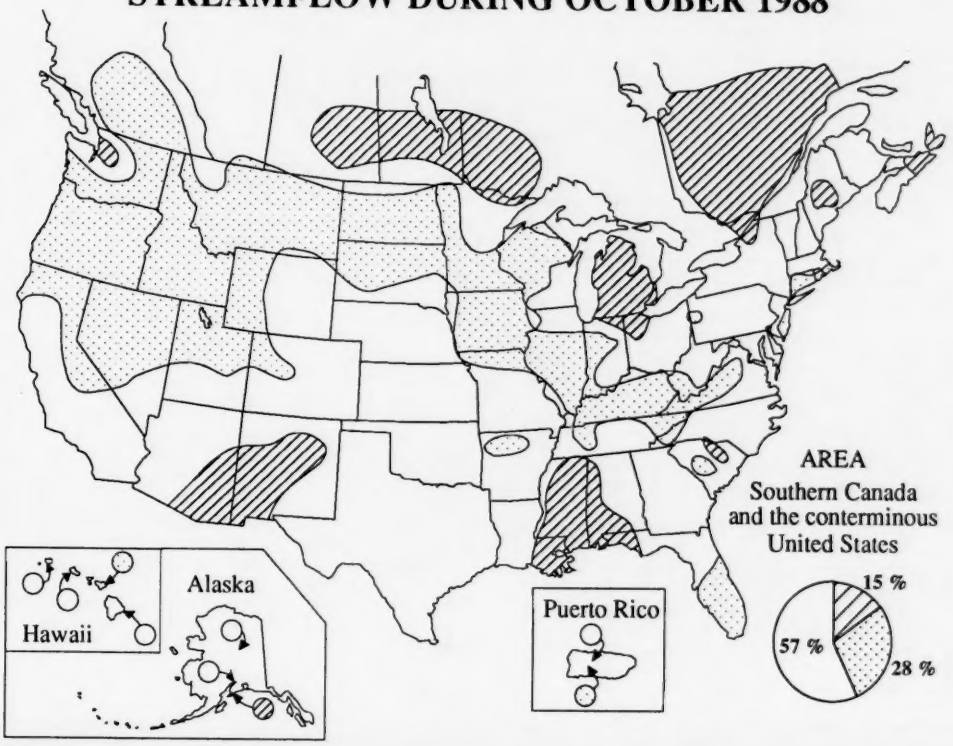

Meherrin River near Lawrenceville, Virginia
Drainage area 552 sq mi
10,000
1,000
100
10
5
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1987
1988
1989


Rappahannock River at Remington, Virginia
Drainage area 620 sq mi
10,000
1,000
100
10
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1987
1988
1989

## STREAMFLOW DURING OCTOBER 1989



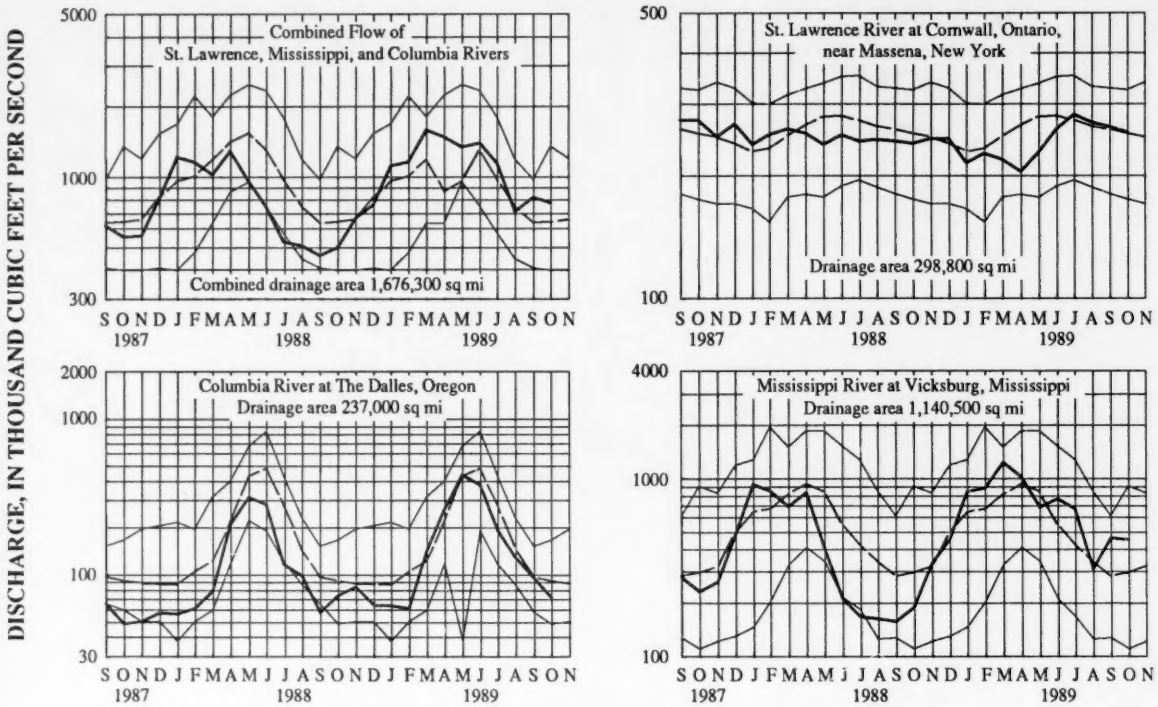

## STREAMFLOW DURING OCTOBER 1988




Above-normal range  Normal range  Below-normal range

## HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.




Provisional data; subject to revision

### DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR OCTOBER 1989, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

| Station number | Station name | September data of following calendar years | Stream discharge during month | Dissolved-solids concentration[a] | | Dissolved-solids discharge[a] | | | Water temperature[b] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | Minimum | Maximum | Mean | Minimum | Maximum | Mean | Minimum | Maximum |
| | | | (cfs) | (mg/L) | (mg/L) | (tons per day) | | | in °C | in °C | in °C |
| 01463500 | Delaware River at Trenton, N.J. (Morrisville, Pa.) | 1989 | 15,744 | 69 | 131 | 3,985 | 1,695 | 13,443 | 13.5 | 10.0 | 17.0 |
| | | 1944-88 (Extreme yr) | 6,585 (1945) | 58 (1953) | 156 | 1,735[e] (1963) | 463 | 8,300 (1955) | 15.0[e] | 8.0 | 25.5 |
| | | | [c]4,918 | | | | | | | | |
| 07289000 | Mississippi River at Vicksburg, Miss. | 1989 | 447,903 | 226 | 256 | 288,161 | 209,189 | 338,197 | 18.0 | 15.5 | 20.5 |
| | | 1975-88 (Extreme yr) | 379,600 (1979, 1982) | 18.3 (1983, 1987) | 337 | 272,400 | 117,000 (1976) | 639,700 (1986) | 20.0 | 15.0 | 26.0 |
| | | | [c]295,000 | | | | | | | | |
| 03612500 | Ohio River at lock and dam 53, near Grand Chain, Ill. (streamflow station at Metropolis, Ill.) | 1989 | 302,000 | 173 | 253 | ..... | 87,800 | 269,000 | ... | 18.0 | 21.0 |
| | | 1954-88 (Extreme yr) | 114,300 ([d]) | 135 (1967) | 330 | ..... | 11,900 (1985) | 262,000 (1976) | ... | 12.0 | 26.0 |
| | | | [c]96,680 | | | | | | | | |
| 06934500 | Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.) | 1989 | 45,200 | 432 | 477 | 56,900 | 52,100 | 65,600 | 17.0 | 14.0 | 20.0 |
| | | 1975-88 (Extreme yr) | 84,630 (1986) | 168 (1980) | 558 | 86,520 | 51,800 (1976) | 272,000 (1986) | 16.5 | 10.0 | 22.5 |
| | | | [c]60,140 | | | | | | | | |
| 14128910 | Columbia River at Warrendale, Oreg. (streamflow station at The Dalles, Oreg.) | 1989 | 109,000 | 97 | 100 | 29,000 | 21,300 | 40,600 | 17.0 | 14.5 | 19.0 |
| | | 1975-88 (Extreme yr) | 117,400 (1981) | 73 (1977) | 117 | 31,400 | 13,200 (1981) | 49,200 (1987) | 16.0 | 11.0 | 19.5 |
| | | | [c]91,570 | | | | | | | | |

[a]Dissolved -solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 x °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.
[d]Occurred several years.
[e]Mean for 5-year period (1984-88).

Provisional data; subject to revision

# FLOW OF LARGE RIVERS DURING OCTOBER 1989

| Station number | Stream and place of determination | Drainage area (square miles) | Average discharge through September 1985 (cubic feet per second) | October 1989 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Monthly mean discharge (cubic feet per second) | Percent of median monthly discharge 1951–80 | Change in discharge from previous month (percent) | Discharge near end of month | | |
| | | | | | | | Cubic feet per second | Million gallons per day | Date |
| 01014000 | St. John River below Fish River at Fort Kent, Maine | 5,665 | 9,758 | 3,088 | 64 | –6 | 2,960 | 1,910 | 31 |
| 01318500 | Hudson River at Hadley, New York | 1,664 | 2,908 | 4,190 | 298 | 50 | 3,200 | 2,070 | 31 |
| 01357500 | Mohawk River at Cohoes, New York | 3,456 | 5,683 | 4,910 | 190 | 93 | 2,200 | 1,420 | 31 |
| 01463500 | Delaware River at Trenton, New Jersey | 6,780 | 11,670 | 15,500 | 315 | 65 | 11,300 | 7,300 | 31 |
| 01570500 | Susquehanna River at Harrisburg, Pennsylvania | 24,100 | 34,340 | 21,350 | 200 | 189 | 23,400 | 15,100 | 29 |
| 01646500 | Potomac River near Washington, District of Columbia | 11,560 | [1]11,500 | [1]9,670 | 340 | 69 | 6,790 | 4,390 | 31 |
| 02105500 | Cape Fear River at William O. Huske Lock, near Tarheel, North Carolina. | 4,852 | 5,002 | 7,400 | 370 | 339 | ... | ... | ... |
| 02131000 | Pee Dee River at Peedee, South Carolina | 8,830 | 9,871 | 24,740 | 533 | 175 | 7,530 | 4,870 | 31 |
| 02226000 | Altamaha River at Doctortown, Georgia | 13,600 | 13,730 | 19,060 | 367 | 251 | 5,690 | 3,680 | 31 |
| 02320500 | Suwannee River at Branford, Florida | 7,880 | 6,986 | 2,436 | 53 | –17 | 2,200 | 1,420 | 31 |
| 02358000 | Apalachicola River at Chattahoochee, Florida | 17,200 | 22,420 | 20,440 | 187 | 49 | 15,600 | 10,100 | 31 |
| 02467000 | Tombigbee River at Demopolis lock and dam, near Coatopa, Alabama. | 15,385 | 23,520 | 15,760 | 402 | 154 | 10,800 | 6,980 | 30 |
| 02489500 | Pearl River near Bogalusa, Louisiana | 6,573 | 9,880 | 3,749 | 177 | 30 | 2,560 | 1,650 | 31 |
| 03049500 | Allegheny River at Natrona, Pennsylvania | 11,410 | [1]19,580 | [1]8,570 | 122 | 26 | 13,200 | 8,530 | 26 |
| 03085000 | Monongahela River at Braddock, Pennsylvania | 7,337 | [1]12,480 | [1]13,100 | 339 | 92 | 14,300 | 9,240 | 26 |
| 03193000 | Kanawha River at Kanawha Falls, West Virginia | 8,367 | 12,550 | 21,560 | 356 | 23 | 11,000 | 7,100 | 26 |
| 03234500 | Scioto River at Higby, Ohio | 5,131 | 4,583 | 1,915 | 252 | 17 | 1,420 | 917 | 31 |
| 03294500 | Ohio River at Louisville, Kentucky[2] | 91,170 | 115,800 | 129,500 | 364 | 22 | 90,700 | 58,600 | 30 |
| 03377500 | Wabash River at Mount Carmel, Illinois | 28,635 | 27,660 | 14,480 | 210 | –72 | 12,700 | 8,210 | 31 |
| 03469000 | French Broad River below Douglas Dam, Tennessee | 4,543 | [1]6,739 | [1]8,513 | -227 | –2 | ..... | ..... | ... |
| 04084500 | Fox River at Rapide Croche Dam, near Wrightstown, Wisconsin.[2] | 6,010 | 4,238 | 2,052 | 92 | 49 | 4,300 | 2,780 | 31 |
| 04264331 | St. Lawrence River at Cornwall, Ontario, near Massena, New York.[3] | 298,800 | 243,900 | 255,000 | 101 | –3 | 255,000 | 165,000 | 31 |
| 02NG001 | St. Maurice River at Grand Mere, Quebec | 16,300 | 24,910 | 17,600 | 93 | 202 | 17,100 | 11,000 | 31 |
| 05082500 | Red River of the North at Grand Forks, North Dakota | 30,100 | 2,593 | 475 | 35 | –50 | 465 | 300 | 27 |
| 05133500 | Rainy River at Manitou Rapids, Minnesota | 19,400 | 12,920 | 6,900 | 63 | –11 | 6,960 | 4,500 | 20 |
| 05330000 | Minnesota River near Jordan, Minnesota | 16,200 | 3,680 | 231 | 22 | –28 | 280 | 180 | 31 |
| 05331000 | Mississippi River at St. Paul, Minnesota | 36,800 | [1]11,020 | 4,226 | 65 | –15 | 4,100 | 2,650 | 31 |
| 05365500 | Chippewa River at Chippewa Falls, Wisconsin | 5,650 | 5,149 | 863 | 31 | –49 | 2,300 | 1,490 | 31 |
| 05407000 | Wisconsin River at Muscoda, Wisconsin | 10,400 | 8,710 | 2,992 | 55 | –17 | 3,400 | 2,200 | 31 |
| 05446500 | Rock River near Joslin, Illinois | 9,549 | 6,080 | 2,620 | 80 | –49 | 2,400 | 1,550 | 31 |
| 05474500 | Mississippi River at Keokuk, Iowa | 119,000 | 63,790 | 21,480 | 61 | –37 | 21,400 | 13,800 | 31 |
| 06214500 | Yellowstone River at Billings, Montana | 11,795 | 7,056 | 3,850 | 91 | 14 | 3,920 | 2,530 | 31 |
| 06934500 | Missouri River at Hermann, Missouri | 524,200 | 80,880 | 45,240 | 75 | –56 | 46,400 | 30,000 | 31 |
| 07289000 | Mississippi River at Vicksburg, Mississippi[4] | 1,140,500 | 584,000 | 447,900 | 152 | –3 | 516,000 | 334,000 | 30 |
| 07331000 | Washita River near Dickson, Oklahoma | 7,202 | 1,402 | 777 | 150 | –69 | 1,300 | 840 | 31 |
| 08276500 | Rio Grande below Taos Junction Bridge, near Taos, New Mexico. | 9,730 | 742 | 298 | 108 | 25 | 296 | 191 | 29 |
| 09315000 | Green River at Green River, Utah | 44,850 | 6,391 | 2,084 | 73 | 49 | ..... | ..... | ... |
| 11425500 | Sacramento River at Verona, California | 21,251 | 19,430 | 12,170 | 115 | –21 | ..... | ..... | ... |
| 13269000 | Snake River at Weiser, Idaho | 69,200 | 18,520 | 13,000 | 89 | 7 | 12,000 | 7,800 | 30 |
| 13317000 | Salmon River at White Bird, Idaho | 13,550 | 11,390 | 4,080 | 82 | 16 | 4,310 | 2,780 | 30 |
| 13342500 | Clearwater River at Spalding, Idaho | 9,570 | 15,510 | 2,600 | 69 | 18 | 2,980 | 1,930 | 30 |
| 14105700 | Columbia River at The Dalles, Oregon[5] | 237,000 | [1]193,500 | [1]71,400 | 78 | –25 | 155,000 | 100,000 | 25 |
| 14191000 | Willamette River at Salem, Oregon | 7,280 | [1]23,690 | [1]3,457 | 51 | –8 | 11,900 | 7,690 | 26 |
| 15515500 | Tanana River at Nenana, Alaska | 25,600 | 23,810 | 18,440 | 119 | –52 | 12,000 | 7,800 | 31 |
| 08MF005 | Fraser River at Hope, British Columbia | 83,800 | 96,250 | 48,380 | 66 | –27 | 49,800 | 32,200 | 31 |

[1]Adjusted.

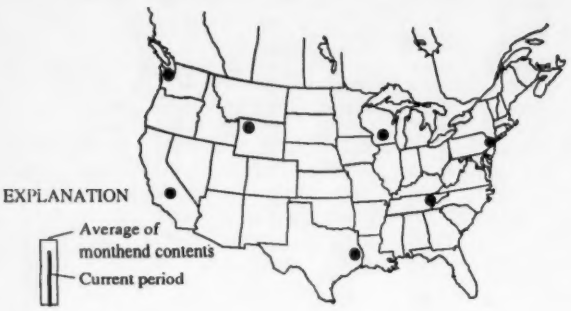
[2]Records furnished by Corps of Engineers.

[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.

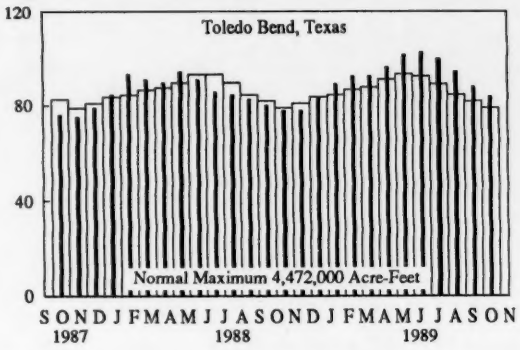
[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.

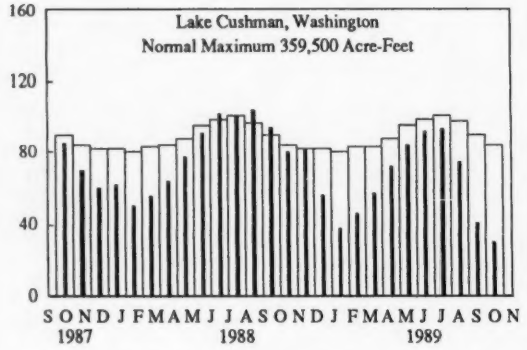
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

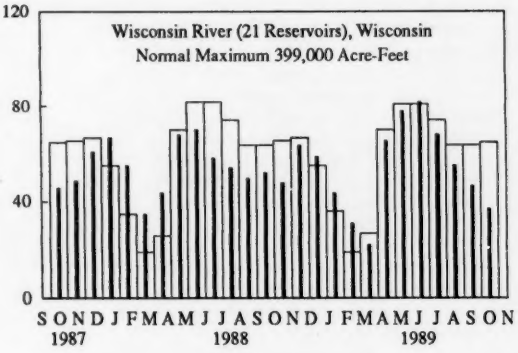
# USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS

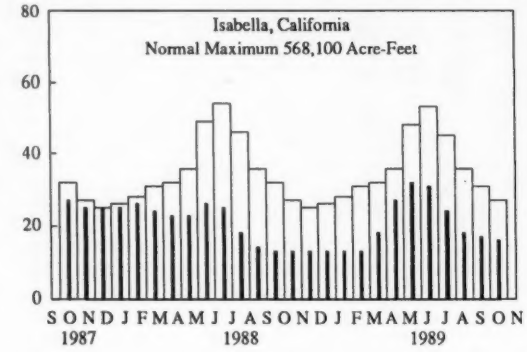


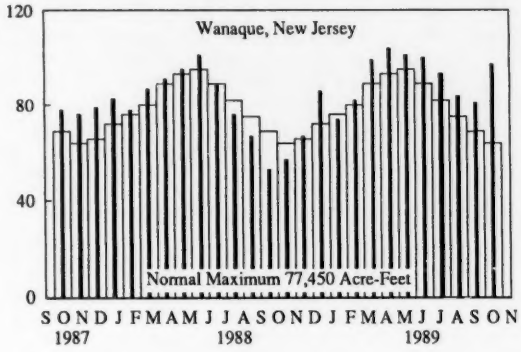

PERCENT OF NORMAL MAXIMUM

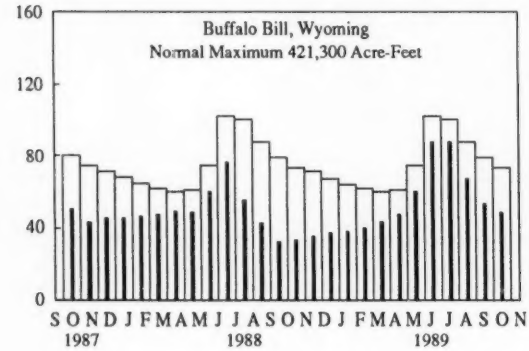


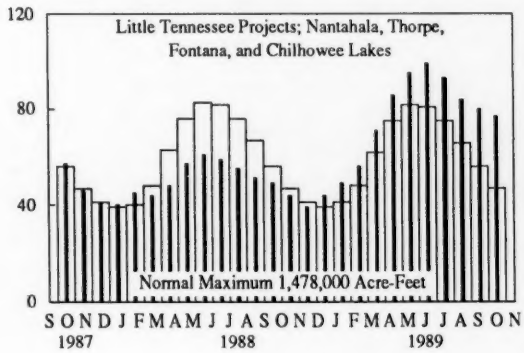





Wisconsin River (21 Reservoirs), Wisconsin
Normal Maximum 399,000 Acre-Feet
120
80
40
0
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1987
1988
1989





Little Tennessee Projects; Nantahala, Thorpe,
Fontana, and Chilhowee Lakes
Normal Maximum 1,478,000 Acre-Feet
120
80
40
0
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1987
1988
1989

# USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF OCTOBER 1989

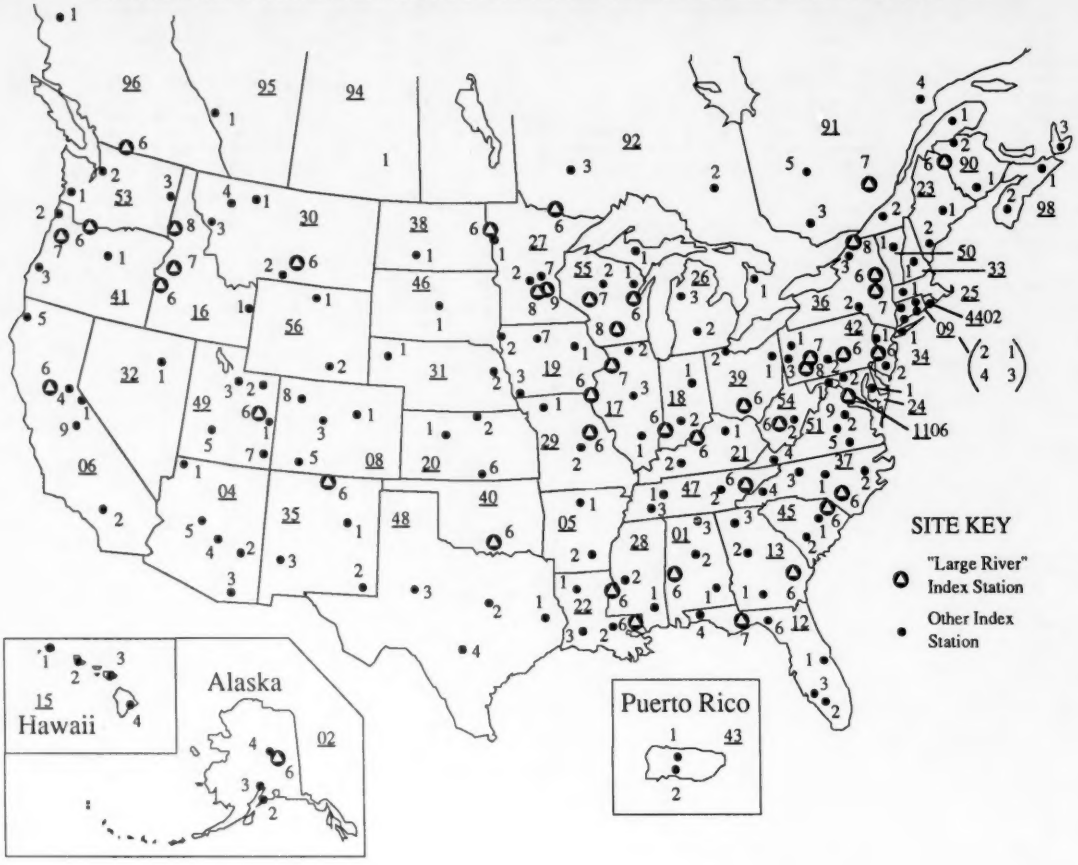
[Contents are expressed in percent of reservoir (system) capacity. The usable storage capacity of each reservoir (system) is shown in the column headed "Normal maximum"]

| Reservoir<br>Principal uses:<br>F-Flood control<br>I-Irrigation<br>M-Municipal<br>P-Power<br>R-Recreation<br>W-Industrial | Percent of normal maximum: End of October 1989 | End of October 1988 | Average for end of October | End of September 1989 | Normal maximum (acre-feet)[a] |
|---|---|---|---|---|---|
| **NOVA SCOTIA** | | | | | |
| Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P) | 40 | 41 | 35 | 46 | [b]226,300 |
| **QUEBEC** | | | | | |
| Allard (P) | 79 | 75 | 59 | 79 | 280,600 |
| Gouin (P) | 51 | 59 | 68 | 53 | 6,954,000 |
| **MAINE** | | | | | |
| Seven Reservoir Systems (MP) | 55 | 57 | 53 | 64 | 4,107,000 |
| **NEW HAMPSHIRE** | | | | | |
| First Connecticut Lake (P) | 78 | 72 | 73 | 89 | 76,450 |
| Lake Francis (FPR) | 87 | 82 | 76 | 79 | 99,310 |
| Lake Winnipesaukee (PR) | 81 | 61 | 57 | 73 | 165,700 |
| **VERMONT** | | | | | |
| Harriman (P) | 82 | 69 | 62 | 70 | 116,200 |
| Somerset (P) | 82 | 75 | 69 | 71 | 57,390 |
| **MASSACHUSETTS** | | | | | |
| Cobble Mountain and Borden Brook (MP) | 96 | 68 | 71 | 88 | 77,920 |
| **NEW YORK** | | | | | |
| Great Sacandaga Lake (FPR) | 84 | 60 | 55 | 81 | 786,700 |
| Indian Lake (FMP) | 76 | 76 | 57 | 89 | 103,300 |
| New York City Reservoir System (MW) | 84 | 54 | 65 | 78 | 1,680,000 |
| **NEW JERSEY** | | | | | |
| Wanaque (M) | 97 | 57 | 64 | 81 | 77,450 |
| **PENNSYLVANIA** | | | | | |
| Allegheny (FPR) | 37 | 35 | 34 | 41 | 1,180,000 |
| Pymatuning (FMR) | 93 | 89 | 80 | 94 | 188,000 |
| Raystown Lake (FR) | 67 | 66 | 57 | 67 | 761,900 |
| Lake Wallenpaupack (PR) | 68 | 62 | 49 | 60 | 157,800 |
| **MARYLAND** | | | | | |
| Baltimore Municipal System (M) | 92 | 75 | 83 | 93 | 261,900 |
| **NORTH CAROLINA** | | | | | |
| Bridgewater (Lake James) (P) | 92 | 91 | 82 | 100 | 288,800 |
| Narrows (Badin Lake) (P) | 92 | 93 | 94 | 96 | 128,900 |
| High Rock Lake (P) | 89 | 49 | 58 | 98 | 234,800 |
| **SOUTH CAROLINA** | | | | | |
| Lake Murray (P) | 89 | 84 | 65 | 84 | 1,614,000 |
| Lakes Marion and Moultrie (P) | 85 | 83 | 68 | 86 | 1,862,000 |
| **SOUTH CAROLINA-GEORGIA** | | | | | |
| Strom Thurmond Lake (FP) | 74 | 25 | 53 | 69 | 1,730,000 |
| **GEORGIA** | | | | | |
| Burton (PR) | 98 | 98 | 70 | 98 | 104,000 |
| Sinclair (MPR) | 90 | 88 | 78 | 89 | 214,000 |
| Lake Sidney Lanier (FMPR) | 65 | 37 | 50 | 61 | 1,686,000 |
| **ALABAMA** | | | | | |
| Lake Martin (P) | 87 | 88 | 69 | 92 | 1,375,000 |
| **TENNESSEE VALLEY** | | | | | |
| Clinch Projects: Norris and Melton Hill Lakes (FPR) | 56 | 30 | 32 | 63 | 2,293,000 |
| Douglas Lake (FPR) | 56 | 20 | 23 | 69 | 1,395,000 |
| Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR) | 71 | 50 | 49 | 85 | 1,012,000 |
| Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR) | 63 | 38 | 40 | 71 | 2,880,000 |
| Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR) | 77 | 44 | 47 | 80 | 1,478,000 |
| **WISCONSIN** | | | | | |
| Chippewa and Flambeau (PR) | 75 | 77 | 79 | 72 | 365,000 |
| Wisconsin River (21 Reservoirs) (PR) | 37 | 48 | 65 | 47 | 399,000 |
| **MINNESOTA** | | | | | |
| Mississippi River Headwater System (FMR) | 33 | 35 | 30 | 30 | 1,640,000 |
| **NORTH DAKOTA** | | | | | |
| Lake Sakakawea (Garrison) (FIPR) | 63 | 65 | 88 | 62 | 22,700,000 |
| **SOUTH DAKOTA** | | | | | |
| Angostura (I) | 40 | 43 | 69 | 40 | 130,770 |
| Belle Fourche (I) | 18 | 18 | 36 | 12 | 185,200 |
| Lake Francis Case (FIP) | 55 | 54 | 61 | 66 | 4,589,000 |
| Lake Oahe (FIP) | 54 | 64 | -- | 57 | 22,240,000 |
| Lake Sharpe (FIP) | 103 | 103 | 98 | 102 | 1,697,000 |
| Lewis and Clark Lake (FIP) | 97 | 98 | 105 | 98 | 432,000 |
| **NEBRASKA** | | | | | |
| Lake McConaughy (IP) | 60 | 69 | 69 | 58 | 1,948,000 |
| **OKLAHOMA** | | | | | |
| Eufaula (FPR) | 97 | 91 | 88 | 105 | 2,378,000 |
| Keystone (FPR) | 86 | 78 | 87 | 98 | 661,000 |
| Tenkiller Ferry (FPR) | 104 | 98 | 92 | 105 | 628,200 |
| Lake Altus (FIMR) | 72 | 64 | 48 | 82 | 133,000 |
| Lake O'The Cherokees (FPR) | 91 | 86 | 83 | 92 | 1,492,000 |
| **OKLAHOMA-TEXAS** | | | | | |
| Lake Texoma (FMPRW) | 93 | 91 | 93 | 99 | 2,722,000 |
| **TEXAS** | | | | | |
| Bridgeport (IMW) | 97 | 63 | 49 | 100 | 386,400 |
| Canyon (FMR) | 88 | 98 | 78 | 89 | 385,600 |
| International Amistad (FIMPW) | 86 | 102 | 86 | 86 | 3,497,000 |
| International Falcon (FIMPW) | 46 | 106 | 76 | 126 | 2,668,000 |
| Livingston (IMW) | 98 | 76 | 85 | 100 | 1,788,000 |
| Possum Kingdom (IMPRW) | 92 | 73 | 98 | 95 | 570,200 |
| Red Bluff (P) | 31 | 57 | 28 | 31 | 307,000 |
| Toledo Bend (P) | 84 | 78 | 79 | 88 | 4,472,000 |
| Twin Buttes (FIM) | 50 | 71 | 33 | 52 | 177,800 |
| Lake Kemp (IMW) | 97 | 66 | 85 | 102 | 268,000 |
| Lake Meredith (FMW) | 41 | 42 | 38 | 42 | 796,900 |
| Lake Travis (FIMPRW) | 64 | 82 | 80 | 68 | 1,144,000 |
| **MONTANA** | | | | | |
| Canyon Ferry (FIMPR) | 73 | 69 | 87 | 71 | 2,043,000 |
| Fort Peck (FPR) | 64 | 72 | 85 | 66 | 18,910,000 |
| Hungry Horse (FIPR) | 61 | 49 | 86 | 63 | 3,451,000 |
| **WASHINGTON** | | | | | |
| Ross (PR) | 81 | 79 | 86 | 88 | 1,052,000 |
| Franklin D. Roosevelt Lake (IP) | 101 | 92 | 101 | 98 | 5,022,000 |
| Lake Chelan (PR) | 77 | 84 | 74 | 90 | 676,100 |
| Lake Cushman (PR) | 30 | 80 | 84 | 41 | 359,500 |
| Lake Merwin (P) | 104 | 64 | 87 | 101 | 245,600 |
| **IDAHO** | | | | | |
| Boise River (4 Reservoirs) (FIP) | 37 | 22 | 47 | 35 | 1,235,000 |
| Coeur d'Alene Lake (P) | 56 | 63 | 54 | 79 | 238,500 |
| Pend Oreille Lake (FP) | 43 | 45 | 67 | 83 | 1,561,000 |
| **IDAHO-WYOMING** | | | | | |
| Upper Snake River (8 Reservoirs) (MP) | 42 | 16 | 50 | 38 | 4,401,000 |
| **WYOMING** | | | | | |
| Boysen (FIP) | 83 | 57 | 83 | 83 | 802,000 |
| Buffalo Bill (IP) | 48 | 33 | 73 | 53 | 421,300 |
| Keyhole (F) | 21 | 27 | 42 | 21 | 193,800 |
| Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I) | 35 | 51 | 47 | 34 | 3,056,000 |
| **COLORADO** | | | | | |
| John Martin (FIR) | 77 | 22 | 16 | 10 | 364,400 |
| Taylor Park (IR) | 75 | 72 | 56 | 81 | 106,200 |
| Colorado-Big Thompson Project (I) | 43 | 66 | 56 | 45 | 730,300 |
| **COLORADO RIVER STORAGE PROJECT** | | | | | |
| Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IPR) | 78 | 86 | -- | 79 | 31,620,000 |
| **UTAH-IDAHO** | | | | | |
| Bear Lake (IPR) | 51 | 56 | 60 | 51 | 1,421,000 |
| **CALIFORNIA** | | | | | |
| Folsom (FIP) | 44 | 18 | 53 | 57 | 1,000,000 |
| Hetch Hetchy (MP) | 59 | 60 | 50 | 68 | 360,400 |
| Isabella (FIR) | 16 | 13 | 27 | 17 | 568,100 |
| Pine Flat (FI) | 4 | 7 | 38 | 4 | 1,001,000 |
| Clair Engle Lake (Lewiston) (P) | 52 | 54 | 69 | 57 | 2,438,000 |
| Lake Almanor (P) | 76 | 68 | 53 | 77 | 1,036,000 |
| Lake Berryessa (FIMW) | 50 | 62 | 74 | 51 | 1,600,000 |
| Millerton Lake (FI) | 28 | 28 | 34 | 28 | 503,200 |
| Shasta Lake (FIPR) | 51 | 37 | 63 | 47 | 4,377,000 |
| **CALIFORNIA-NEVADA** | | | | | |
| Lake Tahoe (IPR) | 8 | 0 | 49 | 11 | 744,600 |
| **NEVADA** | | | | | |
| Rye Patch (I) | 6 | 4 | 53 | 10 | 194,300 |
| **ARIZONA-NEVADA** | | | | | |
| Lake Mead and Lake Mohave (FIMP) | 82 | 87 | 73 | 82 | 27,970,000 |
| **ARIZONA** | | | | | |
| San Carlos (IP) | 6 | 45 | 21 | 6 | 935,100 |
| Salt and Verde River System (IMPR) | 51 | 80 | 40 | 53 | 2,019,100 |
| **NEW MEXICO** | | | | | |
| Conchas (FIR) | 64 | 81 | 80 | 68 | 315,700 |
| Elephant Butte and Caballo (FIPR) | 70 | 84 | 34 | 70 | 2,442,000 |

[a]1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second per day.

[b]Thousands of kilowatt-hours ( the potential electric power that could be generated by the volume of water in storage).

## NATIONAL WATER CONDITIONS STREAMFLOW INDEX STATIONS




Maps and tables on this and the next three pages show the location of, station identification numbers for (both National Water Conditions and U. S. Geological Survey or Canadian Water Resources Branch), and names, of index stations for which streamflow and reservoir data are reported in the National Water Conditions as of October 1, 1989.

Three streamflow index stations were discontinued by the end of the 1989 water year: Little Colorado River near Cameron, Arizona (0406, 09402000); Rapidan River near Culpeper, Virginia (5101, 01667500); and Nottoway River near Stony Creek, Virginia (5103, 02045500).

Four streamflow index stations were added to the National Water Conditions (NWC) reporting network during 1989: Rappahannock River at Remington, Virginia (5109, 01664000); Meherrin River near Lawrenceville, Virginia (5105, 02051500); Shoal River near Crestview, Florida (1204, 02369000); and White River near Meeker, Colorado (808, 09304500).

There were no reservoir index stations dropped or added.

A location map and station list for ground-water index stations used in the NWC will be published when the ground-water index station network is revised.

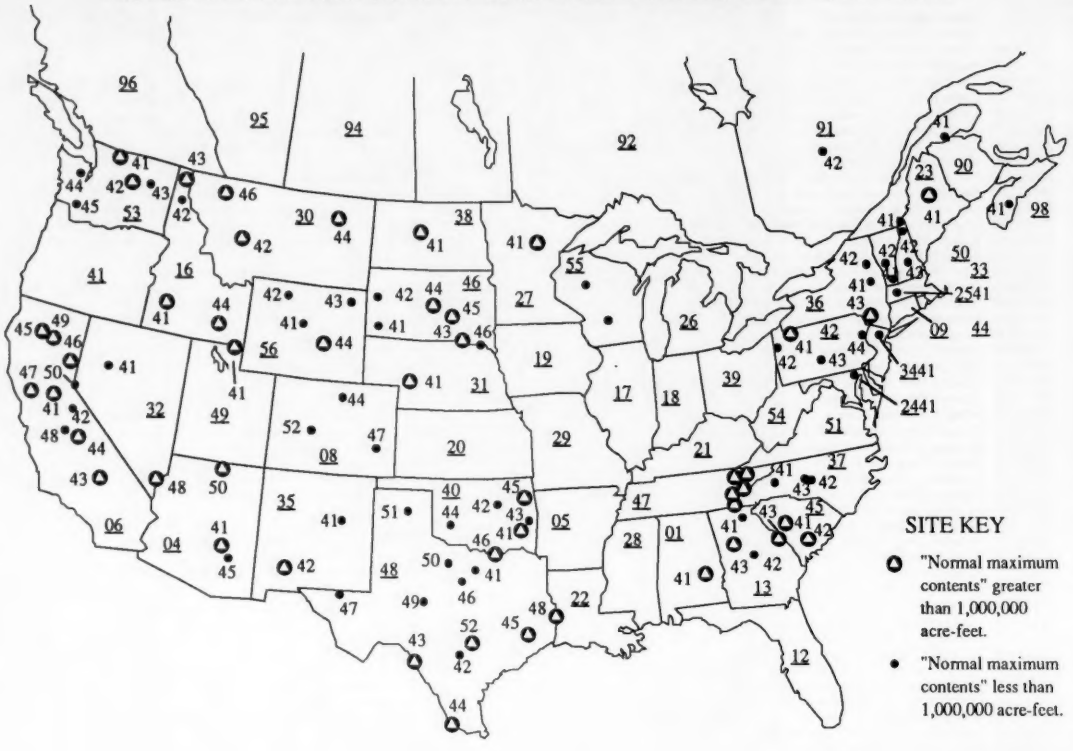
NWC station identification numbers for index sites consist of a two-digit state code combined with a two digit site code. The two-digit site code is between 1 and 10 for streamflow index stations and between 41 and 50 for reservoir index stations.

## NATIONAL WATER CONDITIONS STREAMFLOW INDEX STATIONS

| Station number NWC | USGS | Stream name and location |
|---|---|---|
| 101 | 02371500 | Conecuh River at Brantley, Ala. |
| 102 | 02424000 | Cahaba River at Centreville, Alabama |
| 103 | 03574500 | Paint Rock River near Woodville, Alabama |
| 106 | 02467000 | Tombigbee River at Demopolis Lock & Dam near Coatopa, Alabama |
| 202 | 15258000 | Kenai River at Cooper Landing, Alaska |
| 203 | 15290000 | Little Susitna River near Palmer, Alaska |
| 204 | 15514000 | Chena River at Fairbanks, Alaska |
| 206 | 15515500 | Tanana River at Nenana, Alaska |
| 401 | 09415000 | Virgin River at Littlefield, Arizona |
| 402 | 09448500 | Gila River at Head of Safford Valley near Solomon, Arizona |
| 403 | 09471000 | San Pedro River at Charleston, Arizona |
| 404 | 09498500 | Salt River near Roosevelt, Arizona |
| 405 | 09508500 | Verde River below Tangle Creek, above Horseshoe Dam, Arizona |
| 501 | 07056000 | Buffalo River near St. Joe, Arkansas |
| 502 | 07363500 | Saline River near Rye, Arkansas |
| 601 | 10296000 | West Walker River below Little Walker River, near Coleville, California |
| 602 | 11098000 | Arroyo Seco near Pasadena, California |
| 604 | 11427000 | North Fork American River at North Fork Dam, California |
| 605 | 11532500 | Smith River near Crescent City, California |
| 606 | 11425500 | Sacramento River at Verona, California |
| 609 | 11264500 | Merced River at Happy Isles Bridge, near Yosemite, California |
| 801 | 06710500 | Bear Creek at Morrison, Colorado |
| 803 | 09085000 | Roaring Fork River at Glenwood Springs, Colorado |
| 805 | 09361500 | Animas River at Durango, Colorado |
| 808 | 09304500 | White River near Meeker, Colorado |
| 901 | 01121000 | Mount Hope River near Warrenville, Connecticut |
| 902 | 01188000 | Burlington Brook near Burlington, Connecticut |
| 903 | 01193500 | Salmon River near East Hampton, Connecticut |
| 904 | 01204000 | Pomperaug River at Southbury, Connecticut |
| 1106 | 01646500 | Potomac River (adjusted) near Washington, District of Columbia |
| 1201 | 02232500 | St. Johns River near Christmas, Florida |
| 1202 | 02256500 | Fisheating Creek at Palmdale, Florida |
| 1203 | 02296750 | Peace River at Arcadia, Florida |
| 1204 | 02369000 | Shoal River near Crestview, Florida |
| 1206 | 02320500 | Suwannee River at Branford, Florida |
| 1207 | 02358000 | Apalachicola River at Chattahoochee, Florida |
| 1301 | 02317500 | Alapaha River at Statenville, Georgia |
| 1302 | 02347500 | Flint River near Culloden, Georgia |
| 1303 | 02392000 | Etowah River at Canton, Georgia |
| 1306 | 02226000 | Altamaha River at Doctortown, Georgia |
| 1501 | 16068000 | East Branch of North Fork Wailua River near Lihue, Kauai, Hawaii |
| 1502 | 16229000 | Kalihi Stream near Honolulu, Oahu, Hawaii |
| 1503 | 16587000 | Honopou Stream near Huelo, Maui, Hawaii |
| 1504 | 16700000 | Waiakea Stream near Mountain View, Hawaii, Hawaii |
| 1601 | 13037500 | Snake River (adjusted) near Heise, Idaho |
| 1606 | 13269000 | Snake River at Weiser, Idaho |
| 1607 | 13317000 | Salmon River at White Bird, Idaho |
| 1608 | 13342500 | Clearwater River (adjusted) at Spalding, Idaho |
| 1701 | 03380500 | Skillet Fork at Wayne City, Illinois |
| 1702 | 05435500 | Pecatonica River at Freeport, Illinois |
| 1703 | 05572000 | Sangamon River at Monticello, Illinois |
| 1706 | 03377500 | Wabash River at Mount Carmel, Illinois |
| 1707 | 05446500 | Rock River near Joslin, Illinois |
| 1801 | 03326500 | Mississinewa River at Marion, Indiana |
| 1802 | 03373500 | East Fork White River at Shoals, Indiana |
| 1901 | 05464500 | Cedar River at Cedar Rapids, Iowa |
| 1902 | 06485500 | Big Sioux River at Akron, Iowa |
| 1903 | 06810000 | Nishnabotna River above Hamburg, Iowa |
| 1906 | 05474500 | Mississippi River at Keokuk, Iowa |
| 1907 | 05480500 | Des Moines River at Fort Dodge, Iowa |
| 2001 | 06867000 | Saline River near Russell, Kansas |
| 2002 | 06884400 | Little Blue River near Barnes, Kansas |
| 2006 | 07146500 | Arkansas River at Arkansas City, Kansas |
| 2101 | 03253500 | Licking River (adjusted) at Catawba, Kentucky |
| 2102 | 03308500 | Green River at Munfordville, Kentucky |
| 2106 | 03294500 | Ohio River at Louisville, Kentucky |
| 2201 | 07352000 | Saline Bayou near Lucky, Louisiana |
| 2202 | 07378500 | Amite River near Denham Springs, Louisiana |
| 2203 | 08013500 | Calcasieu River near Oberlin, Louisiana |
| 2206 | 02489500 | Pearl River near Bogalusa, Louisiana |
| 2301 | 01031500 | Piscataquis River near Dover-Foxcroft, Maine |
| 2302 | 01057000 | Little Androscoggin River near South Paris, Maine |
| 2306 | 01014000 | St. John River below Fish River at Fort Kent, Maine |
| 2401 | 01491000 | Choptank River near Greensboro, Maryland |
| 2402 | 01645000 | Seneca Creek at Dawsonville, Maryland |
| 2501 | 01173000 | Ware River (adjusted) at Intake Works near Barre, Massachusetts |
| 2601 | 04040500 | Sturgeon River near Sidnaw, Michigan |
| 2602 | 04112500 | Red Cedar River at East Lansing, Michigan |
| 2603 | 04121500 | Muskegon River at Evart, Michigan |
| 2701 | 05062000 | Buffalo River near Dilworth, Minnesota |
| 2702 | 05280000 | Crow River at Rockford, Minnesota |
| 2706 | 05133500 | Rainy River at Manitou Rapids, Minnesota |
| 2707 | 05288500 | Mississippi River near Anoka, Minnesota |
| 2708 | 05330000 | Minnesota River near Jordan, Minnesota |
| 2709 | 05331000 | Mississippi River at St. Paul, Minnesota |
| 2801 | 02479000 | Pascagoula River at Merrill, Mississippi |
| 2802 | 07290000 | Big Black River near Bovina, Mississippi |
| 2806 | 07289000 | Mississippi River at Vicksburg, Mississippi |
| 2901 | 06897500 | Grand River near Gallatin, Missouri |
| 2902 | 06933500 | Gasconade River at Jerome, Missouri |
| 2906 | 06934500 | Missouri River at Hermann, Missouri |
| 3001 | 06099500 | Marias River near Shelby, Montana |
| 3002 | 06191500 | Yellowstone River at Corwin Springs, Montana |
| 3003 | 12354500 | Clark Fork at St. Regis, Montana |
| 3004 | 12358500 | Middle Fork Flathead River near West Glacier, Montana |
| 3006 | 06214500 | Yellowstone River at Billings, Montana |

| Station number NWC | USGS | Stream name and location |
|---|---|---|
| 3101 | 06454500 | Niobrara River above Box Butte Reservoir, Nebraska |
| 3102 | 06800500 | Elkhorn River at Waterloo, Nebraska |
| 3201 | 10322500 | Humboldt River at Palisade, Nevada |
| 3301 | 01076500 | Pemigewasset River at Plymouth, New Hampshire |
| 3401 | 01396500 | South Branch Raritan River near High Bridge, New Jersey |
| 3402 | 01411000 | Great Egg Harbor River at Folsom, New Jersey |
| 3406 | 01463500 | Delaware River at Trenton, New Jersey |
| 3501 | 08378500 | Pecos River near Pecos, New Mexico |
| 3502 | 08408500 | Delaware River near Red Bluff, New Mexico |
| 3503 | 09430500 | Gila River near Gila, New Mexico |
| 3506 | 08276500 | Rio Grande below Taos Junction Bridge, near Taos, New Mexico |
| 3601 | 01309500 | Massapequa Creek at Massapequa, New York |
| 3602 | 01503000 | Susquehanna River at Conklin, New York |
| 3603 | 04262500 | West Branch Oswegatchie River near Harrisville, New York |
| 3606 | 01318500 | Hudson River at Hadley, New York |
| 3607 | 01357500 | Mohawk River at Cohoes, New York |
| 3608 | 04264331 | St. Lawrence River at Cornwall, Ontario, near Massena, New York |
| 3701 | 02102000 | Deep River at Moncure, North Carolina |
| 3702 | 02091500 | Contentnea Creek at Hookerton, North Carolina |
| 3703 | 02118000 | South Yadkin River near Mocksville, North Carolina |
| 3704 | 03451500 | French Broad River at Asheville, North Carolina |
| 3706 | 02105500 | Cape Fear River at William O. Huske Lock near Tarheel, North Carolina |
| 3801 | 06354000 | Cannonball River at Breien, North Dakota |
| 3806 | 05082500 | Red River of the North at Grand Forks, North Dakota |
| 3901 | 03109500 | Little Beaver Creek near East Liverpool, Ohio |
| 3902 | 04193500 | Maumee River at Waterville, Ohio |
| 3906 | 03234500 | Scioto River at Higby, Ohio |
| 4006 | 07331000 | Washita River near Dickson, Oklahoma |
| 4101 | 14046500 | John Day River at Service Creek, Oregon |
| 4102 | 14301500 | Wilson River near Tillamook, Oregon |
| 4103 | 14321000 | Umpqua River near Elkton, Oregon |
| 4106 | 14105700 | Columbia River (adjusted) at The Dalles, Oregon |
| 4107 | 14191000 | Willamette River (adjusted) at Salem, Oregon |
| 4201 | 03020500 | Oil Creek at Rouseville, Pennsylvania |
| 4202 | 03079000 | Casselman River at Markleton, Pennsylvania |
| 4203 | 03106000 | Connoquenessing Creek near Zelienople, Pennsylvania |
| 4206 | 01570500 | Susquehanna River at Harrisburg, Pennsylvania |
| 4207 | 03049500 | Allegheny River (adjusted) at Natrona, Pennsylvania |
| 4208 | 03085000 | Monongahela River (adjusted) at Braddock, Pennsylvania |
| 4301 | 50038100 | Rio Grande De Manati at Highway 2 near Manati, Puerto Rico |
| 4302 | 50112500 | Rio Inabon at Real Abajo, Puerto Rico |
| 4402 | 01117500 | Pawcatuck River at Wood River Junction, Rhode Island |
| 4501 | 02132000 | Lynches River at Effingham, South Carolina |
| 4502 | 02173500 | North Fork Edisto River at Orangeburg, South Carolina |
| 4506 | 02131000 | Pee Dee River at Peedee, South Carolina |
| 4601 | 06441500 | Bad River near Fort Pierre, South Dakota |
| 4701 | 03434500 | Harpeth River near Kingston Springs, Tennessee |
| 4702 | 03540500 | Emory River at Oakdale, Tennessee |
| 4703 | 03604500 | Buffalo River near Lobelville, Tennessee |
| 4706 | 03469000 | French Broad River (adjusted) below Douglas Dam, Tennessee |
| 4801 | 08033500 | Neches River near Rockland, Texas |
| 4802 | 08095000 | North Bosque River near Clifton, Texas |
| 4803 | 08134000 | North Concho River near Carlsbad, Texas |
| 4804 | 08167500 | Guadalupe River near Spring Branch, Texas |
| 4901 | 09180500 | Colorado River near Cisco, Utah |
| 4902 | 09299500 | Whiterocks River near Whiterocks, Utah |
| 4903 | 10128500 | Weber River near Oakley, Utah |
| 4905 | 10234500 | Beaver River near Beaver, Utah |
| 4906 | 09315000 | Green River at Green River, Utah |
| 4907 | 09379500 | San Juan River near Bluff, Utah |
| 5001 | 04287000 | Dog River at Northfield Falls, Vermont |
| 5102 | 02030500 | Slate River near Arvonia, Virginia |
| 5104 | 03488000 | North Fork Holston River near Saltville, Virginia |
| 5105 | 02051500 | Meherrin River near Lawrenceville, Virginia |
| 5109 | 01664000 | Rappahannock River at Remington, Virginia |
| 5301 | 12027500 | Chehalis River near Grand Mound, Washington |
| 5302 | 12134500 | Skykomish River near Gold Bar, Washington |
| 5303 | 12422500 | Spokane River (adjusted) at Spokane, Washington |
| 5401 | 01610000 | Potomac River at Paw Paw, West Virginia |
| 5402 | 03183500 | Greenbrier River at Alderson, West Virginia |
| 5406 | 03193000 | Kanawha River at Kanawha Falls, West Virginia |
| 5501 | 04071000 | Oconto River near Gillett, Wisconsin |
| 5502 | 05362000 | Jump River at Sheldon, Wisconsin |
| 5506 | 04084500 | Fox River at Rapide Croche Dam, near Wrightstown, Wisconsin |
| 5507 | 05365500 | Chippewa River at Chippewa Falls, Wisconsin |
| 5508 | 05407000 | Wisconsin River at Muscoda, Wisconsin |
| 5601 | 06298000 | Tongue River near Dayton, Wyoming |
| 5602 | 06630000 | North Platte River above Seminoe Reservoir near Sinclair, Wyoming |
| 9001 | 01AQ001 | Lepreau River at Lepreau, New Brunswick |
| 9002 | 01BE001 | Upsalquitch River at Upsalquitch, New Brunswick |
| 9101 | 02QB001 | Matane River near Matane, Quebec |
| 9102 | 02OF002 | St. Francois River at Hemmings Falls, Quebec |
| 9103 | 02KG001 | Coulonge River near Fort Coulonge, Quebec |
| 9104 | 02TE001 | Outardes River at Outardes Falls, Quebec |
| 9105 | 04NA001 | Harricana River at Amos, Quebec |
| 9107 | 02NG001 | St. Maurice River at Grand Mere, Quebec |
| 9201 | 02FC001 | Saugeen River near Port Elgin, Ontario |
| 9202 | 04LJ001 | Missinaibi River at Mattice, Ontario |
| 9203 | 05QA002 | English River at Umfreville, Ontario |
| 9401 | 05JF001 | Qu'Appelle River near Lumsden, Saskatchewan |
| 9501 | 05BB001 | Bow River at Banff, Alberta, Canada |
| 9601 | 08EF001 | Skeena River at USK, British Columbia |
| 9606 | 08MF005 | Fraser River at Hope, British Columbia |
| 9801 | 01EO001 | St. Mary's River at Stillwater, Nova Scotia |
| 9802 | 01EF001 | La Have River at West Northfield, Nova Scotia |
| 9803 | 01FB001 | Northeast Margaree River at Margaree Valley, Nova Scotia |

## NATIONAL WATER CONDITIONS RESERVOIR INDEX STATIONS




Monthend index reservoir contents for October 1989 were in the below-average range (below the monthend average for the period of record by more than 5 percent of normal maximum contents) at 22 of 100 reporting sites, compared with 30 of 100 during September 1989, including most reservoirs in Nebraska, the Dakotas, Wyoming, Montana, Idaho, California, and Nevada. Contents were in the above-average range at 44 reservoirs (compared with 46 last month) , including most reservoirs in New Hampshire, Vermont, Massachusetts, New York, New Jersey, Maryland, the Carolinas, Georgia, Alabama, the Tennessee Valley, Oklahoma, and Arizona. Reservoirs with contents in the below-average range and significantly lower than last year (with normal maximum contents of at least 1,000,000 acre-feet) were: Gouin, Quebec; International Falcon, Texas; Lake McConaughy, Nebraska; Lake Oahe, South Dakota; Fort Peck, Montana; the Pathfinder and associated reservoirs, Wyoming; Bear Lake, Idaho-Utah; and Lake Berryessa, California. Graphs of contents for seven reservoirs are shown on page 8 with contents for the 100 reporting reservoirs given on page 9.

Mean October elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range on all the lakes except Lake Superior. Levels declined from those for September on all 4 lakes. October 1989 levels ranged from 0.25 foot (Lake Superior) to 0.50 foot lower (Lake Erie) than those for September. Monthly means on Lake Superior had been in the normal range 11 months before this month. Monthly means have been in the normal range for 27 months on Lake Huron, 19 months on Lake Erie, and 6 months on Lake Ontario. October 1989 levels ranged from 0.45 feet higher (Lake Ontario) to 0.29 foot lower (Lake Huron) than those for October 1988. Stage hydrographs for the master gages on Lake Superior, Lake Huron, Lake Erie, and Lake Ontario are on page 16.

Utah's Great Salt Lake (graph on page 16) declined 0.20 foot to 4,204.50 feet above National Geodetic Vertical Datum of 1929 on October 31. The lake has declined 2.30 feet since the seasonal high of April 1-15, is 2.10 feet lower than at the end of October 1988, and 7.35 feet lower than the maximum of record which occurred in June 1986 and March-April 1987.

Precipitation in the United States during October 1989 (provisional National Weather Service data) is shown by maps on page 17.

November 1989-January 1990 outlook maps for both temperature and precipitation are on page 19. Temperature is likely to be above median in southeastern California and adjacent Arizona, and also in an area including parts of all the Atlantic Coast States and extending into the central Great Lakes States. Below-median temperatures are likely in the area extending from Oregon and Washington to the central and southern Great Plains. Precipitation is likely to be above median in a large area extending from the northern Texas-Oklahoma border (Red River) through central Ohio. Below-median precipitation is likely in central California and a small part of adjacent Nevada.

# NATIONAL WATER CONDITIONS RESERVOIR INDEX STATIONS

The usable storage capacity of each reservoir is shown in the column headed "Normal maximum"

| Station identification number NWC | Station identification number USGS | PROVINCE, STATE, OR AREA Reservoir or System | Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial F | I | M | P | R | W | Normal maximum (acre-feet)[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | **NOVA SCOTIA** | | | | | | | |
| 9841 | | Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs | | | | x | | | [b]226,300 |
| | | **QUEBEC** | | | | | | | |
| 9141 | | Allard | | | | x | | | 280,600 |
| 9142 | | Gouin | | | | x | | | 6,954,000 |
| | | **MAINE** | | | | | | | |
| 2341 | 01127000 | Seven Reservoir Systems | | | x | x | | | 4,107,000 |
| | | **NEW HAMPSHIRE** | | | | | | | |
| 3341 | 01127850 | First Connecticut Lake | | | | x | | | 76,450 |
| 3342 | 01129000 | Lake Francis | x | | | x | x | | 99,310 |
| 3343 | 01080000 | Lake Winnipesaukee | | | | x | x | | 165,700 |
| | | **VERMONT** | | | | | | | |
| 5041 | 01168000 | Harriman | | | | x | | | 116,200 |
| 5042 | 01167490 | Somerset | | | | x | | | 57,390 |
| | | **MASSACHUSETTS** | | | | | | | |
| 2541 | 01182500 | Cobble Mountain and Borden Brook | | | x | x | | | 77,920 |
| | | **NEW YORK** | | | | | | | |
| 3641 | 01323500 | Great Sacandaga Lake | x | | | x | x | | 786,700 |
| 3642 | 01314500 | Indian Lake | x | | x | x | | | 103,300 |
| 3643 | 01416900 | New York City Reservoir System | | | x | | | x | 1,680,000 |
| | | **NEW JERSEY** | | | | | | | |
| 3441 | 01386990 | Wanaque | | | x | | | | 77,450 |
| | | **PENNSYLVANIA** | | | | | | | |
| 4241 | 03012550 | Allegheny | x | | | x | x | | 1,180,000 |
| 4242 | 03310050 | Pymatuning | x | | x | | x | | 188,000 |
| 4243 | 01563100 | Raystown Lake | x | | | | x | | 761,900 |
| 4244 | 01431700 | Lake Wallenpaupack | | | | x | x | | 157,800 |
| | | **MARYLAND** | | | | | | | |
| 2441 | 01589000 | Baltimore Municipal System | | | x | | | | 261,900 |
| | | **NORTH CAROLINA** | | | | | | | |
| 3741 | 02138519 | Bridgewater (Lake James) | | | | x | | | 288,800 |
| 3742 | 02122844 | Narrows (Badin Lake) | | | | x | | | 128,900 |
| 3743 | 02122400 | High Rock Lake | | | | x | | | 234,800 |
| | | **SOUTH CAROLINA** | | | | | | | |
| 4541 | 02168500 | Lake Murray | | | | x | | | 1,614,000 |
| 4542 | 02171000 | Lakes Marion and Moultrie | | | | x | | | 1,862,000 |
| | | **SOUTH CAROLINA-GEORGIA** | | | | | | | |
| 4543 | 02194500 | Strom Thurmond Lake | x | | | x | | | 1,730,000 |
| | | **GEORGIA** | | | | | | | |
| 1341 | 02178500 | Burton | | | | x | x | | 104,000 |
| 1342 | 02222500 | Sinclair | | | x | x | x | | 214,000 |
| 1343 | 02334400 | Lake Sidney Lanier | x | | x | x | x | | 1,686,000 |
| | | **ALABAMA** | | | | | | | |
| 0141 | 02417500 | Lake Martin | | | | x | | | 1,375,000 |
| | | **TENNESSEE VALLEY** | | | | | | | |
| 4741 | 03532500 | Clinch Projects: Norris and Melton Hill Lakes | x | | | x | x | | 2,293,000 |
| 4742 | 03468500 | Douglas Lake | x | | | x | x | | 1,395,000 |
| 4743 | 03554500 | Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes | x | | | x | x | | 1,012,000 |
| 4744 | 03493500 | Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes | x | | | x | x | | 2,880,000 |
| 4745 | 03514500 | Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes | x | | | x | x | | 1,478,000 |
| | | **WISCONSIN** | | | | | | | |
| 5541 | 05355600 | Chippewa and Flambeau | | | | x | x | | 365,000 |
| 5542 | 05401400 | Wisconsin River (21 Reservoirs) | | | | x | x | | 399,000 |
| | | **MINNESOTA** | | | | | | | |
| 2741 | 05201000 | Mississippi River Headwater System | x | | x | | x | | 1,640,000 |
| | | **NORTH DAKOTA** | | | | | | | |
| 3841 | 06338000 | Lake Sakakawea (Garrison) | x | x | | x | x | | 22,700,000 |
| | | **SOUTH DAKOTA** | | | | | | | |
| 4641 | 06401000 | Angostura | | x | | | | | 130,770 |
| 4642 | 06435000 | Belle Fourche | | x | | | | | 185,200 |
| 4643 | 06452500 | Lake Francis Case | x | x | | x | | | 4,589,000 |
| 4644 | 06439980 | Lake Oahe | x | x | | x | | | 22,240,000 |
| 4545 | 06444270 | Lake Sharpe | x | x | | x | | | 1,697,000 |
| 4646 | 06467000 | Lewis and Clark Lake | x | x | | x | | | 432,000 |
| | | **NEBRASKA** | | | | | | | |
| 3141 | 0669000 | Lake McConaughy | | x | | x | | | 1,948,000 |
| | | **OKLAHOMA** | | | | | | | |
| 4041 | 07244800 | Eufaula | x | | | x | x | | 2,378,000 |
| 4042 | 07164200 | Keystone | x | | | x | x | | 661,000 |
| 4043 | 07197500 | Tenkiller Ferry | x | | | x | x | | 628,200 |
| 4044 | 07302500 | Lake Altus | x | x | x | | x | | 133,000 |
| 4045 | 07190000 | Lake O'The Cherokees | x | | | x | x | | 1,492,000 |
| | | **OKLAHOMA-TEXAS** | | | | | | | |
| 4046 | 07331500 | Lake Texoma | x | | x | x | x | x | 2,722,000 |
| | | **TEXAS** | | | | | | | |
| 4841 | 08043000 | Bridgeport | | x | x | | | x | 386,400 |
| 4842 | 08167700 | Canyon | x | | x | | x | | 385,600 |
| 4843 | 08450800 | International Amistad | x | x | x | x | | x | 3,497,000 |
| 4844 | 08461200 | International Falcon | x | x | x | x | | x | 2,668,000 |
| 4845 | 08066191 | Livingston | | x | x | | | x | 1,788,000 |
| 4846 | 08088500 | Possum Kingdom | | x | x | x | x | x | 570,200 |
| 4847 | 08410000 | Red Bluff | | x | | x | | | 307,000 |
| 4848 | 08025350 | Toledo Bend | | | | x | | | 4,472,000 |
| 4849 | 08131200 | Twin Buttes | x | x | x | | | | 177,800 |
| 4850 | 07312000 | Lake Kemp | | x | x | | | x | 268,000 |
| 4851 | 07227900 | Lake Meredith | x | | x | | | x | 796,900 |
| 4852 | 08154500 | Lake Travis | x | x | x | x | x | x | 1,144,000 |
| | | **MONTANA** | | | | | | | |
| 3042 | 06058500 | Canyon Ferry | x | x | x | x | x | | 2,043,000 |
| 3044 | 06131500 | Fort Peck | x | | | x | x | | 18,910,000 |
| 3046 | 12362000 | Hungry Horse | x | x | | x | x | | 3,451,000 |
| | | **WASHINGTON** | | | | | | | |
| 5341 | 12175000 | Ross | | | | x | x | | 1,052,000 |
| 5342 | 12436000 | Franklin D. Roosevelt Lake | | x | | x | | | 5,022,000 |
| 5343 | 12452000 | Lake Chelan | | | | x | x | | 676,100 |
| 5344 | 12057000 | Lake Cushman | | | | x | x | | 359,500 |
| 5345 | 14220000 | Lake Merwin | | | | x | | | 245,600 |
| | | **IDAHO** | | | | | | | |
| 1641 | 13190000 | Boise River (4 Reservoirs) | x | x | | x | | | 1,235,000 |
| 1642 | 12415500 | Coeur d'Alene Lake | | | | x | | | 238,500 |
| 1643 | 12392500 | Pend Oreille Lake | x | | | x | | | 1,561,000 |
| | | **IDAHO-WYOMING** | | | | | | | |
| 1644 | 13076500 | Upper Snake River (8 Reservoirs) | | | x | x | | | 4,401,000 |
| | | **WYOMING** | | | | | | | |
| 5641 | 06258900 | Boysen | x | x | | x | | | 802,000 |
| 5642 | 06281500 | Buffalo Bill | | x | | x | | | 421,300 |
| 5643 | 06427000 | Keyhole | x | | | | | | 193,800 |
| 5644 | 06635500 | Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs | | x | | | | | 3,056,000 |
| | | **COLORADO** | | | | | | | |
| 0847 | 07130000 | John Martin | x | x | | | x | | 364,400 |
| 0852 | 09108500 | Taylor Park | | x | | | x | | 106,200 |
| 0844 | 09018500 | Colorado-Big Thompson Project | | x | | | | | 730,300 |
| | | **COLORADO RIVER STORAGE PROJECT** | | | | | | | |
| 0850 | 09379900 | Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs | x | x | | x | x | | 31,620,000 |
| | | **UTAH-IDAHO** | | | | | | | |
| 4941 | 10055500 | Bear Lake | | x | | x | x | | 1,421,000 |
| | | **CALIFORNIA** | | | | | | | |
| 0641 | 11446200 | Folsom | x | x | | x | | | 1,000,000 |
| 0642 | 11275500 | Hetch Hetchy | | | x | x | | | 360,400 |
| 0643 | 11190500 | Isabella | x | x | | | x | | 568,100 |
| 0644 | 11221000 | Pine Flat | x | x | | | | | 1,001,000 |
| 0645 | 11525400 | Clair Engle Lake (Lewiston) | | | | x | | | 2,438,000 |
| 0646 | 11399000 | Lake Almanor | | | | x | | | 1,036,000 |
| 0647 | 11453900 | Lake Berryessa | x | x | x | | | x | 1,600,000 |
| 0648 | 11250100 | Millerton Lake | x | x | | | | | 503,200 |
| 0649 | 11370000 | Shasta Lake | x | x | | x | x | | 4,377,000 |
| | | **CALIFORNIA-NEVADA** | | | | | | | |
| 0650 | 10337000 | Lake Tahoe | | x | | x | x | | 744,600 |
| | | **NEVADA** | | | | | | | |
| 3241 | 10334500 | Rye Patch | | x | | | | | 194,300 |
| | | **ARIZONA-NEVADA** | | | | | | | |
| 0448 | 09421000 | Lake Mead and Lake Mohave | x | x | x | x | | | 27,970,000 |
| | | **ARIZONA** | | | | | | | |
| 0441 | 09469000 | San Carlos | | x | | x | | | 935,100 |
| 0445 | 09501000 | Salt and Verde River System | | x | x | x | x | | 2,019,100 |
| | | **NEW MEXICO** | | | | | | | |
| 3541 | 07223500 | Conchas | x | x | | | x | | 315,700 |
| 3542 | 08360500 | Elephant Butte and Caballo | x | x | | x | x | | 2,442,000 |

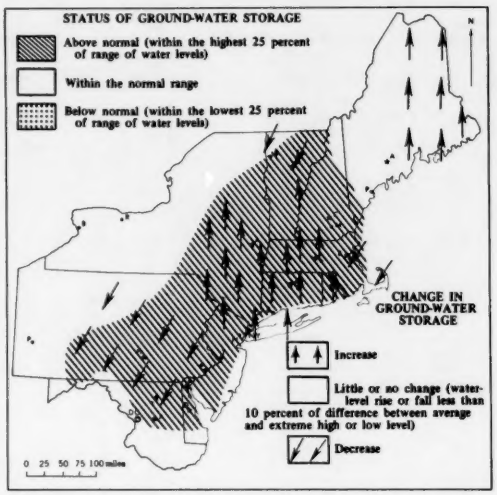
[a]1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second per day.

[b]Thousands of kilowatt-hours ( the potential electric power that could be generated by the volume of water in storage).

## GROUND-WATER CONDITIONS DURING OCTOBER 1989

Ground-water levels continued a seasonal decline in much of the southern part of the Northeast; including parts of Pennsylvania, Maryland, Delaware, and New Jersey; in the coastal part of Massachusetts; and in northern Vermont. Levels rose in the east-central part of the Northeast, in parts of Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, Vermont, and New Hampshire. Above-average water levels persisted in most of the central and southeastern parts of the region (see map). Elsewhere in the Northeast, levels were in the average range. Record high levels for October occurred in key wells in Charlestown, Rhode Island, and near Glover Village and West Fairlee Village, Vermont. A low occurred in Milton, Vermont.

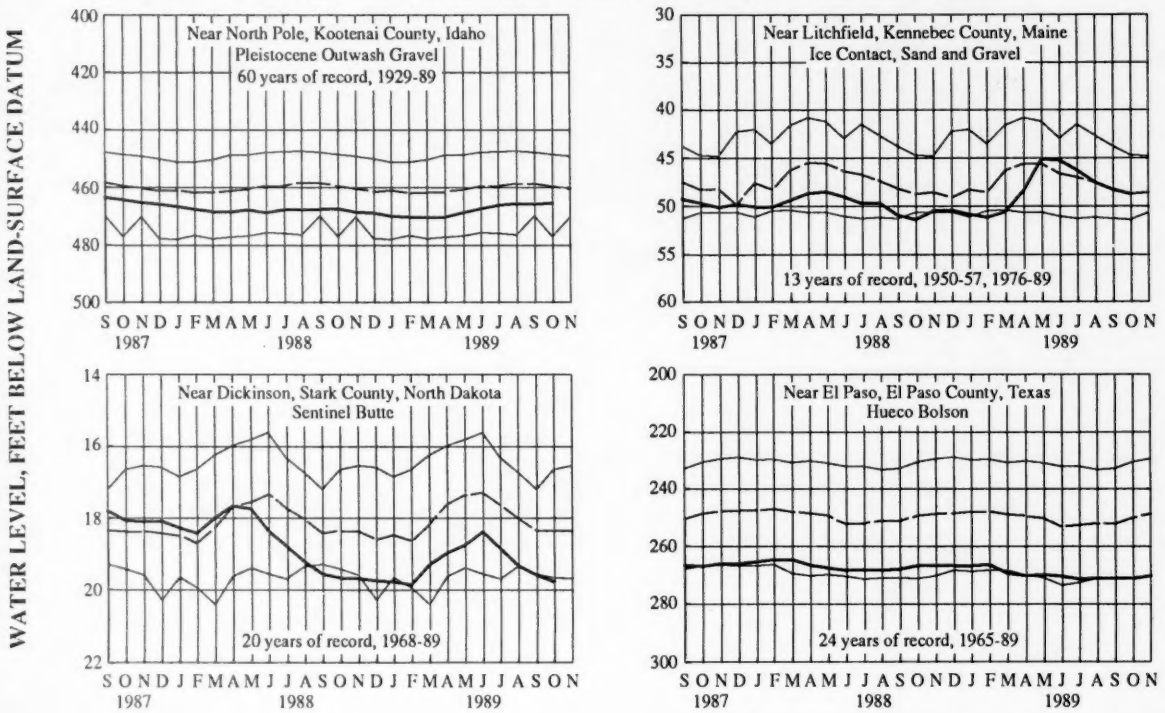
In the Southeastern States, ground-water levels rose in most of West Virginia, Virginia, Arkansas, and much of Georgia and Florida. Ground-water levels declined in most of Mississippi. Elsewhere net changes in levels were mixed. Water levels were above long-term averages in West Virginia, Kentucky, Virginia, North Carolina,


STATUS OF GROUND-WATER STORAGE
Above normal (within the highest 25 percent of range of water levels)
Within the normal range
Below normal (within the lowest 25 percent of range of water levels)
N
CHANGE IN GROUND-WATER STORAGE
Increase
Little or no change (water-level rise or fall less than 10 percent of difference between average and extreme high or low level)
Decrease
0 25 50 75 100 miles

Map showing ground-water storage near end of October and change in ground-water storage from end of September to end of October.

## MONTHEND GROUND-WATER LEVELS IN KEY WELLS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.


WATER LEVEL, FEET BELOW LAND-SURFACE DATUM
Near North Pole, Kootenai County, Idaho
Pleistocene Outwash Gravel
60 years of record, 1929-89
Near Litchfield, Kennebec County, Maine
Ice Contact, Sand and Gravel
13 years of record, 1950-57, 1976-89
Near Dickinson, Stark County, North Dakota
Sentinel Butte
20 years of record, 1968-89
Near El Paso, El Paso County, Texas
Hueco Bolson
24 years of record, 1965-89
S O N D J F M A M J J A S O N D J F M A M J J A S O N
1987
1988
1989

and most of Georgia, and below average in Arkansas, Louisiana, and Florida. New high water levels for October occurred at key wells in Glenville, West Virginia and at the U.S. Geological Survey National Center in Reston, Virginia. New October lows occurred in key wells in Ruston, Louisiana and in spite of a net rise since last month, on Cockspur Island, Georgia.

In the central and western Great Lakes States, ground-water levels fell in all states except Minnesota and Ohio where net changes were mixed. Levels were below long-term averages in Minnesota and Wisconsin, and mixed with respect to average in Michigan and Iowa.

In the Western States, ground-water levels rose in Washington and most of Idaho and declined in North Dakota and Southern California. Elsewhere net changes in levels were mixed. Levels remain below average throughout much of the west including Washington, Idaho, North Dakota, Nebraska, Southern California, Kansas, and Arizona. Water-levels were mixed with respect to average in Nevada, Utah, New Mexico, and Texas. Record October lows occurred in key wells in Dickinson, North Dakota, and in spite of net rises, in Las Vegas Valley, Nevada, and the Agricultural Experimental Station in Colby County, Kansas.

Provisional data; subject to revision

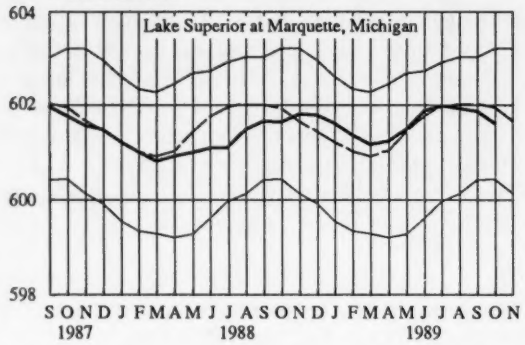
## WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES--OCTOBER 1989

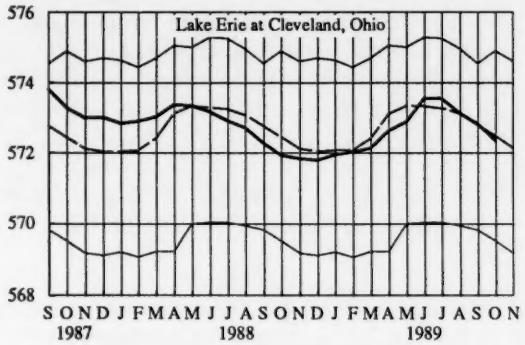
| Aquifer and Location | Water level in feet with reference to land-surface datum | Departure from average in feet | Net change in water level in feet since: Last month | Last year | Year records began | Remarks |
|---|---|---|---|---|---|---|
| Glacial drift at Hanska, south-central Minnesota ..... | –14.35 | -5.69 | -3.45 | -2.10 | 1942 | |
| Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan. | -5.48 | -0.53 | -0.09 | -0.57 | 1935 | |
| Glacial drift at Marion, Iowa..... | -8.90 | -2.26 | -1.43 | -3.67 | 1941 | |
| Glacial drift at Princeton in northwestern Illinois..... | -7.80 | -6.71 | -1.20 | +2.22 | 1943 | |
| Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia. | -15.25 | +1.12 | +0.69 | +2.09 | 1939 | |
| Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2). | -18.91 | +5.93 | -0.09 | -1.60 | 1946 | |
| 500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2). | -106.98 | -16.27 | +0.04 | +0.83 | 1941 | |
| Weathered granite, Mocksville area, Davie County, western Piedmont, North Carolina. | -16.22 | +4.48 | +0.09 | +2.02 | 1932 | |
| Sparta Sand in Pine Bluff industrial area, Arkansas .. | -236.40 | -27.81 | +0.50 | +4.50 | 1958 | |
| Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4). | -28.0 | -4.5 | +0.8 | +2.1 | 1952 | |
| Upper Floridan aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6). | -37.42 | -9.47 | +0.38 | -1.45 | 1956 | Oct. low |
| Sand and gravel in Puget Trough, Tacoma, Washington. | -108.07 | -2.07 | +10.16 | -0.99 | 1952 | |
| Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3). | -465.5 | -5.7 | +0.4 | +1.9 | 1929 | |
| Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4). | -118.0 | -3.6 | +0.1 | +1.0 | 1957 | |
| Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9). | -30.48 | +0.92 | +3.33 | -8.08 | 1929 | |
| Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6). | -6.64 | -0.23 | -0.24 | +1.78 | 1935 | |
| Alluvial valley fill in Steptoe Valley, Nevada..... | -7.94 | +4.80 | +0.38 | -0.27 | 1950 | |
| Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas. | -23.80 | -3.24 | 0 | -0.43 | 1953 | |
| Alluvium and Paso Robles clay, sand, and gravel, Santa Maria Valley, California. | -150.0 | -9.42 | -3.0 | -11.0 | 1957 | |
| Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15). | -99.68 | -17.17 | +0.19 | +1.24 | 1951 | |
| Hueco bolson, El Paso area, Texas ..... | -271.33 | -21.02 | -0.24 | +0.02 | 1965 | |
| Evangeline aquifer, Houston area, Texas ..... | -298.87 | +7.72 | -2.42 | +9.28 | 1965 | |

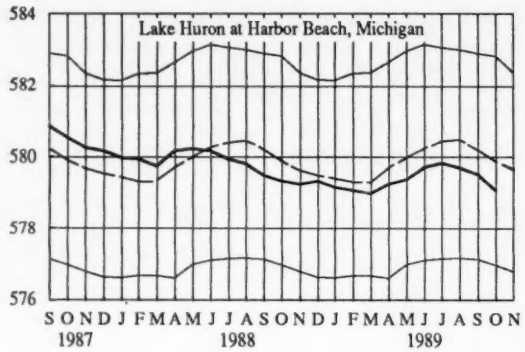
## GREAT LAKES ELEVATIONS

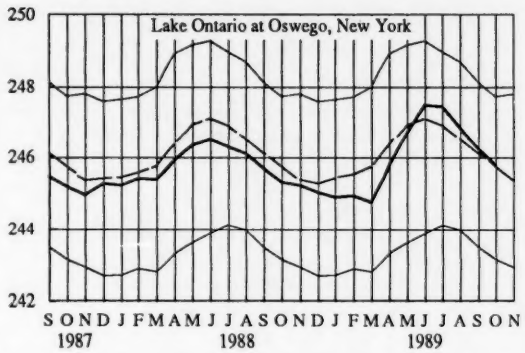
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.

ELEVATION, IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM OF 1929

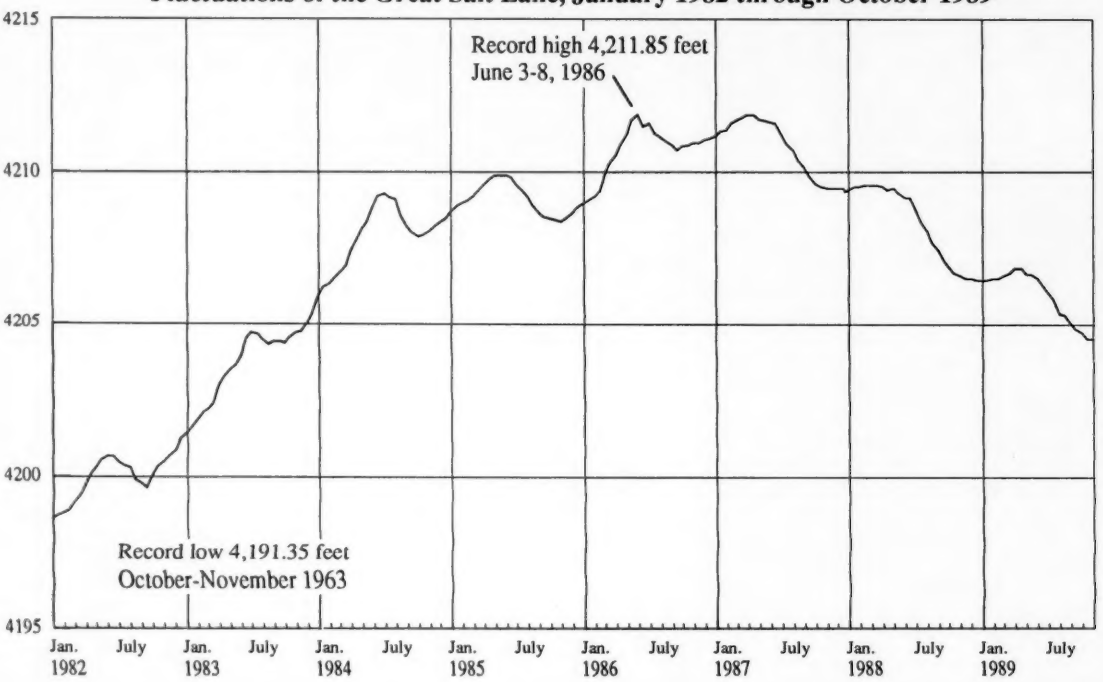


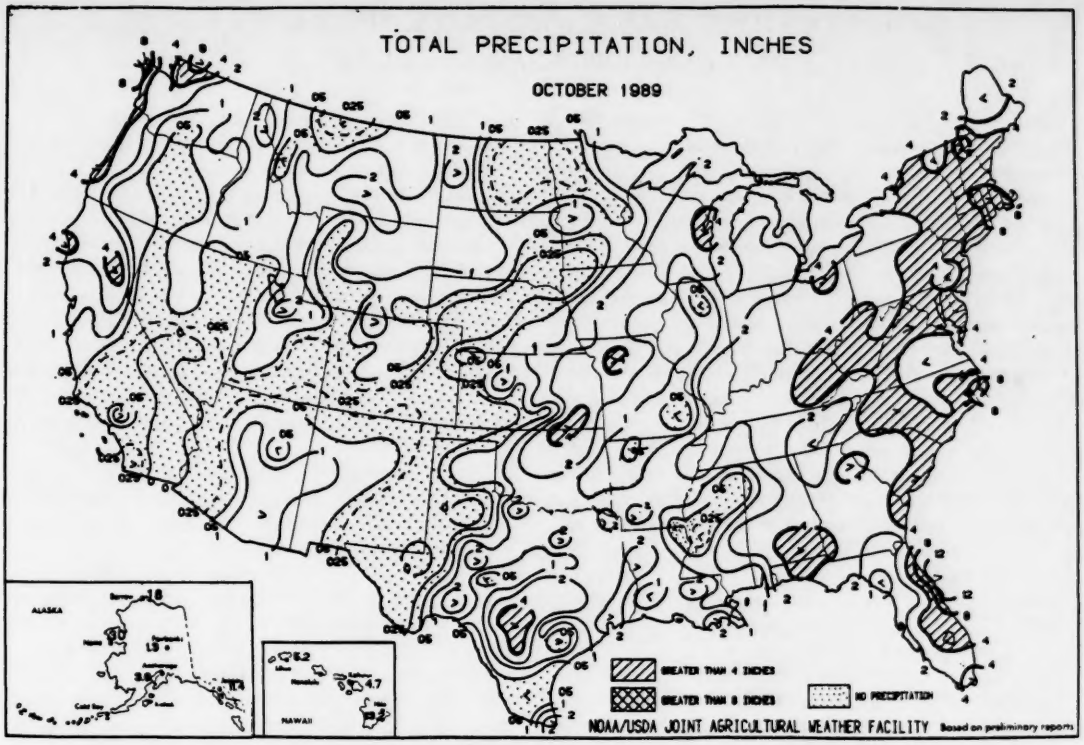



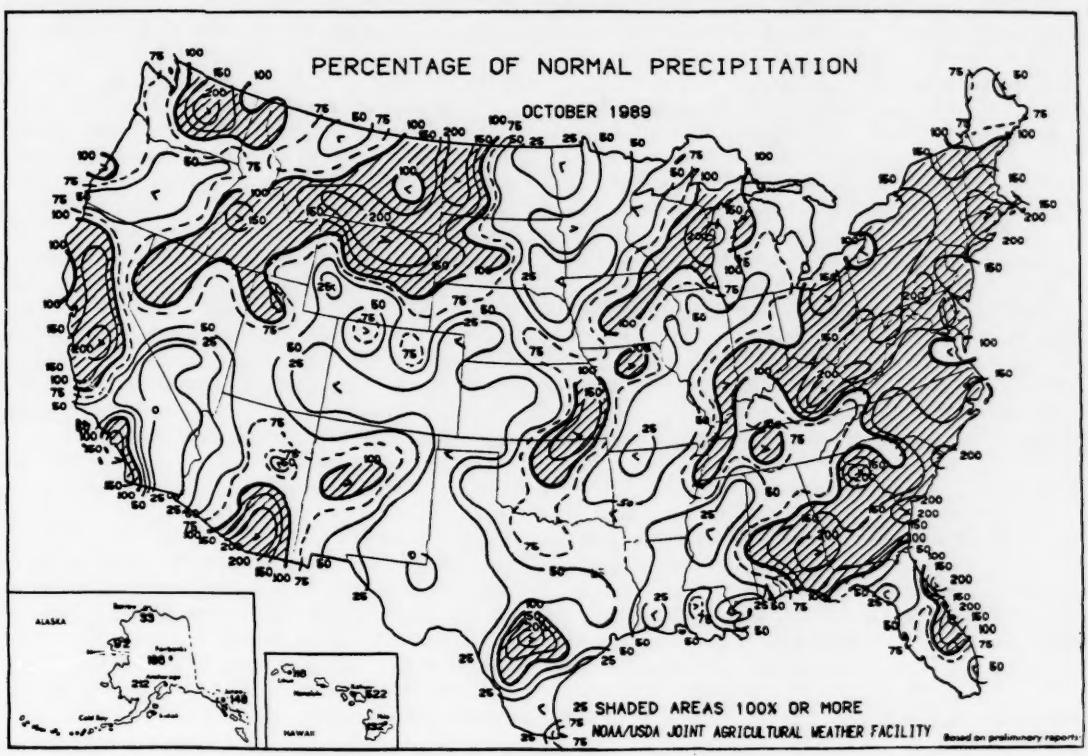




### Fluctuations of the Great Salt Lake, January 1982 through October 1989






(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Facility)

# SUMMARY OF HYDROLOGIC EVENTS FOR THE 1989 WATER YEAR

## October 1, 1988-September 30, 1989

Minor flooding in the upper Snoqualmie River basin, unusual only in the occurrence of any floods at this time of year in the Pacific Northwest, was caused by a storm which stalled in the central Cascade Mountains east of Seattle, Washington, October 15-16. At least one jokulhlaup (glacial outburst flood) occurred on Tahoma Creek below Tahoma Glacier on Mt. Rainier, on October 16.

At the end of January 1989, contents of the New York City reservoir system were only 56 percent of normal maximum. Diversions of water from the Delaware River basin reservoirs in the City's system were reduced to 70 percent of the maximum usually allowed.

In southwestern Florida, the South Florida Water Management District imposed further water-use restrictions in parts of Lee and Collier Counties on January 16, 1989, limiting lawn-watering to only two days a week during the hours of 4-8 a.m. Water levels in all the fresh-water aquifers in southwest Florida were at or near historical lows. Below-normal rainfall , combined with population increases and increases in citrus-grove acreage, caused the acute water shortages in the area.

On February 1, 1989, storage in the 153 major reservoirs in California was only 2.9 million acre-feet greater than on February 1, 1977, the driest year of record in that State. About half of that increased storage was in reservoirs built since 1977.

At the end of February, Lake Tahoe, straddling California and Nevada, had no usable storage for the fifth consecutive month.

Water-use restrictions remained in effect during February in parts of California, New York, New Jersey, and Florida. In southwestern Florida, ground-water levels in major aquifers continued to decline, setting all-time lows. Localized minor limestone collapses (1-4 foot drops in land surface) occurred in the area.

Utah's Great Salt Lake rose to 4,206.80 feet above National Geodetic Vertical Datum of 1929 on March 31. (This was the seasonal high for the lake, which declined 2.10 feet by September 30, 1989. On that date, the lake level was 2.70 feet lower than at the end of September 1988, and 7.15 feet lower than the maximum of record which occurred in June 1986 and March-April 1987.)

Flooding occurred along the Red River of the North in April.

The April mean level of Lake Ontario at Oswego, New York, rose 1.04 feet from that for March (provisional National Ocean Service data), owing to a decrease in the amount of water allowed to be used for power generation. Mean levels on Lake Ontario generally had been declining since the June 1988 seasonal high, and there was essentially no seasonal rise in the fall of 1988.

Severe floods occurred in the Houston, Texas, area where 13.56 inches of rain fell during May, 7.78 inches in one 24-hour period. Flooding also occurred in Ohio after heavy rains on May 25-26, but was much less severe. However, several people were killed when a temporary bridge over the Great Miami River near Miamitown was washed out by the floods, and two other people were killed, one in Hancock County, the other in Clark County.

On May 12, water-withdrawal and water-use restrictions ended in New York City and the Delaware River basin after 6 inches of rain fell May 1-11.

In southwestern Michigan, heavy rains caused record-breaking floods June 1-4 at eight stations on the St. Joseph River and its tributaries. On June 8-9, 3-15 inches of rain fell on Florida's panhandle and the area east of Mobile Bay in Alabama (Baldwin County), causing several streams to exceed either peaks of record or the 100-year flood. Three people were killed by a tornado in the Eastpoint area of the Florida panhandle on June 9. In Texas, severe flooding was caused by the heavy rains of Tropical Storm Allison, with unofficial amounts of up to 16 inches of rain reported in the Houston (Harris County) area. Flood records set prior to 1989 were exceeded at 7 stations during the June 26-27 floods. In Pennsylvania, heavy rains caused severe flooding June 20-22 in the Clarion River basin (about 70 miles northwest of State College).

On July 5, heavy rains caused severe floods on some streams in northern New Castle County, Delaware. The Elsmere, Wilmington, Stanton, and Newark areas were most severely affected. Three persons drowned and damages in New Castle County were estimated at $5 million.

Severe floods occurred in the Anchorage, Alaska, area in late August. About 4.1 inches of rain fell in 24 hours on August 25-26 at the Anchorage Airport National Weather Service gage, breaking the previous 24-hour rainfall record. Total rainfall August 24-28 was almost 7 inches at Anchorage. Less severe flooding occurred in both the Kenai Peninsula Borough and Seward. Damages in Anchorage were estimated at $5 million, while damages in Seward and Kenai Peninsula Borough were estimated at $1 million.

On September 15-16, thunderstorms stalled over Fayetteville, North Carolina, caused flash floods, 2 drownings, the evacuation of more than 400 homes, and more than $10 million in damages in the city. The most intense rain — as much as 4.5 inches in two hours — fell from 6:30 to 8:30 p.m on September 15. There were reports of storm totals of as much as 8.25 inches.

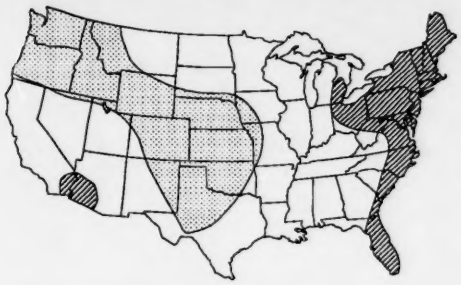
On September 17-18, Hurricane Hugo passed over the U.S. Virgin Islands and Puerto Rico, causing many deaths and severe damages. Hugo moved onshore at Charleston, South Carolina, September 21-22, where 17 deaths occurred because of the storm. The storm cut at least one new inlet from the Atlantic Ocean to the Intracoastal Waterway through Pawley's Island, South Carolina, and damaged several bridges from the mainland to barrier islands. Hugo's storm surge hit about 1 hour before high tide causing severe coastal flooding and damage from Charleston north to southern North Carolina. Preliminary estimates indicate that the storm surge peaked at about 17 feet above mean low water in the vicinity of McClellanville, about 48 miles up the coast from Charleston. Power outages affected at least half a million people in South Carolina as public utilities and roads were damaged in seven counties. Damage estimates in that State alone were about $3 billion.

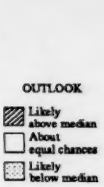
On September 24, about 11 inches of rain in Jacksonville, Florida, caused two deaths, evacuation of parts of the Westside area of the city, and the closing of Interstate Highways 10 and 95.

At the end of September 1989, reservoirs with contents in the below-average range and significantly lower than last year (with normal maximum contents of at least 1,000,000 acre-feet) were: Lake Travis, Texas; Lake McConaughy, Nebraska; Lake Francis Case and Lake Oahe, South Dakota; Fort Peck, Montana; Keyhole and also the Pathfinder and associated reservoirs, Wyoming; Bear Lake, Idaho-Utah; and Lake Berryessa, California.

Mean September elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range on all four lakes for the fifth consecutive month.

TEMPERATURE OUTLOOK FOR NOVEMBER 1989-JANUARY 1990






PRECIPITATION OUTLOOK FOR NOVEMBER 1989-JANUARY 1990

# NATIONAL WATER CONDITIONS

## OCTOBER 1989

Based on reports from the Canadian and U.S. Field offices; completed November 22, 1989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## EXPLANATION OF DATA (Revised November 1989)

***Cover map*** shows generalized pattern of streamflow for the month based on provisional data from 184 index gaging stations—18 in Canada, 164 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, and the Puerto Rico index stations because of the limited records available.

The ***streamflow ranges map*** shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. Three ***pie charts*** show: the percent of stations reporting discharges in each flow range for both the conterminous United States and southern Canada, and also the percent of area in each flow range for the conterminous United States and southern Canada. The bar graph shows total mean and total median flow for all reporting stations in the conterminous United States and southern Canada.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range), 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as: in the ***above-normal range*** if it is greater than the upper quartile, in the ***normal range*** if it is between the upper and lower quartiles, and in the ***below-normal range*** if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as ***seasonal*** if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as ***contraseasonal*** (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

***Flood frequency analyses*** define the relation of flood peak magnitude to probability of occurrence or recurrence interval. ***Probability of occurrence*** is the chance that a given flood magnitude will be exceeded in any one year. ***Recurrence interval*** is the reciprocal of probability of occurrence and is the average number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. ***Recurrence intervals imply no regularity of occurrence***; a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about ***ground-water levels*** refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. ***Changes in ground-water levels***, unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). ***Dissolved solids*** are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. ***Dissolved-solids discharge*** represents the total daily amount of dissolved minerals carried by the stream. ***Dissolved-solids concentrations*** are generally higher during periods of low streamflow, but the highest dissolved-solids discharges occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.



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